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THE ANCIENT MAN OF CALAVERAS.

BY W. O. AYRES.

IN the minds of almost all, the existence of prehistoric man in California is associated mainly with the famous "Calaveras skull," and inasmuch as doubt has been cast on the authenticity of that relic, the whole subject has been badly neglected, and even by men of science has been unreasonably set aside. We will speak of that skull presently, but it is only one of the many evidences to be considered, and we will at first put it out of view. We shall find that if it had never come to light at all, the proofs that man existed when, or rather before, the auriferous gravel was deposited, are so complete that he who doubts them would as readily doubt that Napoleon Bonaparte died on the Island of St. Helena.

The auriferous gravel of the books is the pay-dirt of the miners, and that we may know what the existence of man at the time of its deposit means, we must endeavor to ascertain how long ago that deposit occurred. If we say to a geologist that the gravel is of Pliocene age, he carries back his thoughts over an interval of which the years reckoned by thousands are never counted, though he knows the thousand must be very many. But for those to whom Pliocene and Post-pliocene sound like barbarous terms it may be possible to adduce a form of proof which appeals to the eye, and which brings with it therefore, a force which all can appreciate.

It is well to state at the outset that the pay-dirt is manifestly all of one formation and of one geological age, wherever we find it. Some of it is lying opened and exposed; we will let that pass. Some of it is covered by volcanic rock, and of course is itself older than the rock; that is, the lava flowed out and cov-

ered the gravel after the gravel was in its present form and position. That is sure, for after the gravel was thus imbedded, it has most certainly never been disturbed until within these last few years the miners have dug into it in search of gold. To the gravel then below the lava, we will turn our attention.

Looking out from Carson hill, in Calaveras county, you see across the Stanislas in Tuolumne, a long mountain ridge. It extends down into the plain, where it ends very abruptly, while its upper limit is out of sight away among the main heights of the Sierra Nevada. It looks like a huge railroad embankment, and suggests to you that idea, but men do not make railroad dykes forty miles long and 1500 to 3000 feet high. That which gives it its smooth even upper surface is basalt, that is, ancient lava; the lower part is of looser materials. The thickness of the basalt varies at different points, being here and there hundreds of feet thicker than it is at other places a mile or two either above or below. This is Table mountain, a name which has been famous in the history of California, as we shall see.

The question occurs to us: How came Table mountain to exist? That basalt, when it was erupted, was fluid like other lava. How could it be piled up so thick and so abrupt (for its sides are often perpendicular) on that high mountain ridge, and remain there? Why did it not spread itself out laterally and cover the plain? But one answer to these questions can be given: *There was no plain.*

When that eruption took place, and the crater or fissure opened, far up near the summit of the Sierra Nevada, it naturally flowed into the bed of the first stream which crossed its track. This it filled and followed down until, when the eruption ended, the old river bed, away down to the plain, was blocked up by tne solid volcanic rock, and the waters which should have been there, were finding their way by some other track.

As time passed on, the side of the mountain range was yielding to atmospheric influences. The flowing water was carrying off the softer material on each side of the hard basalt, which had filled and obliterated the old river-bed; the Tuolumne river on the south and the Stanislas on the north, with their tributaries, were formed, and scooped out their present valleys, and thus Table mountain, which had been deposited in the bed of an old mountain torrent, with high ridges confining it, became itself a

ridge, standing like a wall above all which adjoined it. But beneath the basalt lay the stones and gravel and sand and clay which made the bed of the ancient torrent, as they do of the modern streams. And like the modern streams, their predecessor, in age but not in locality, was rich in gold, and thanks to this gold, we know something of the Ancient Man of Calaveras and Tuolumne. We know him because he has left his mark among the stones and gravel.

In what are called the "early days" in '49 and '50, the southern mines were specially noted and productive. Don Pedro's bar and Hawkin's bar on the Tuolumne were crowded with miners, and all the region about Sonora, and Columbia, and Shaw's flat, was swarming like a hive. The gold which was obtained had been brought down in company with the gravel from the mountain heights far above, by the rush of water, ages before. Wherever an old channel could be found in which the flow of water had been confined to narrow limits and to whirling eddies, there the gold had been deposited more abundantly, and rich strikes were made. While exploring these surface deposits, an old river-bed was struck at Shaw's flat, in 1854, which showed features quite distinct from the "diggings" adjacent, and in following out this discovery it became manifest that Table mountain, as already stated, was simply a mass of lava filling an ancient torrent cañon, and that the gravel thus buried was in various places most wonderfully rich. This was the beginning of Table mountain mining.

The whole matter had very much the character of a lottery, for the expense of running a tunnel under the mountain was very great, and the result entirely uncertain, commonly rich to even a fabulous degree, or on the contrary a total failure. The failures were many and the losses destructive to the fortunes of the men interested, but the wild excitement of golden possibilities lured multitudes along, and for years and years in succession Table mountain was bored and tunneled most completely. It is not for us now to speak of the triumph or the heart-ache which went with the work; we know well that

> "No minstrel ever sung or told
> A song so sweet as chink of gold,"

and nowhere, even in that land of enchantment, was the wild and fatal fascination of the search more fully felt than at Table moun-

tain. But that goes by us. Out of these tunnels came the tokens of the past, and we see shadowy visions of the ancient man looming up.

But we will first try to measure off the interval since the Table mountain lava flowed; not that we can specify it in figures, but we may learn enough to reverence its extent. We will consider but one feature. This is the magnitude of the work which has been done by streams of water since the period of volcanic eruption of which mention has been made.

The western slope of the Sierra Nevada is furrowed with enormous gorges reaching from the summit ridges to the plains of the Sacramento and the San Joaquim. Any one of them may be taken as a type of all the others. At their upper part they are, of course, shallow and narrow; a few hundred feet deep and a quarter to half a mile wide, more or less, but steadily increasing in both dimensions. Before they reach their debouchure they are ten to twenty miles wide and two to four thousand feet deep. Standing far up among the higher ranges and following with the eye the stupendous furrow through its windings, fifteen, thirty, forty miles, till all is lost in the blueness of depth and of distance, one often tries to roll back the tide of time and get some glimpse of the days when that plowshare began its work. But the blueness of the chasm is only a faint index of the dimness which comes across the mental vision. It is idle to suggest to one thus standing and looking down the cañon of the Yuba, or the American, or the Tuolumne, that water can have done that work (and water certainly has done it) within an interval which, reckoning years by thousands, must not have written against it *very, very many.* We will not specify how many, but the number surely is great.

And all this scooping out of cañons, this furrowing the western Sierra slope into its configuration of the present era, has been done since the Table mountain lava flowed. Of that there can be no question. The evidence is too plain to admit a doubt.

If now we find the remains of man, or works which none but man could have made, among the gravel-beds beneath Table mountain, or in any other place amid the undisturbed pay-dirt, we cannot fail to know that human hands and human brains had done their work before the immense cañons of the Sierra Nevada commenced their formation in the little furrows near the summit down which the waters trickled.

We can take the proofs only in brief, and we will take none but those which are absolutely established and authentic.

Dr. Perez Snell, of Sonora, had in his collection (this collection has unfortunately perished by fire) a human jaw which was brought out in a carload of "pay-dirt" from a shaft stretching far in beneath the Table mountain, and with it were several stone implements. Dr. Snell did not himself see this bone in the car as it was drawn to the surface, and in the minds of some a doubt might thus be thrown on its authenticity. The specimen was given to him by a miner. If it were an isolated instance this would be possibly worth considering, but it is only one of many, and at the same time it is only fair to state that there could not well have been found a miner in all that region who would have thought it worth his while to attempt a deception, nor even one who had any doubt in his own mind as to the point we are considering. They saw the products of man's work come out with the gravel too often to pay commonly any attention to them. The only wonder is that he even took the trouble to pick out the bone at all. There can be no question that for one such that has been preserved, dozens and perhaps hundreds have gone down in the current of water in the sluice washing.

In 1857 Col. Hubbs, who was afterward State Superintendent of Instruction, found in a load of "dirt" as it came out from his claim under Table mountain, portions of a human skull. He was on the ground himself, and saw the fragments as they were taken out of the sluice. They had come from a distance of 180 feet beneath the lava. One of the pieces is now in the collection of the Boston Society of Natural History; the other in that of the Philadelphia Academy.

Mr. O. W. Stevens certifies that in 1853 he found in a shaft under Table mountain, "about two hundred feet in," a relic that resembled a large stone bead, of white marble, about an inch and a half long and an inch and a fourth in diameter, with a hole through it a fourth of an inch across.

Dr. Snell had in his collection a stone muller or pestle which he took with his own hands from a car load of "dirt" as it came out from under Table mountain.

Mr. Llewellyn Price certifies that in 1862 he dug up a stone mortar under Table mountain at a depth of about 200 feet from the surface and about 1800 feet in from the mouth of the tunnel.

But why need we specify any further single instances. The witnesses already given were all credible and worthy men, they could have had no possible collusion, they had no motive for deception, and the circumstances were such that they could not well be deceived as to what they stated. If any candid person will not be convinced by the evidence they give, he would be equally incredulous were a hundred more to testify to the same truths.

And the hundred more could be summoned were it worth the

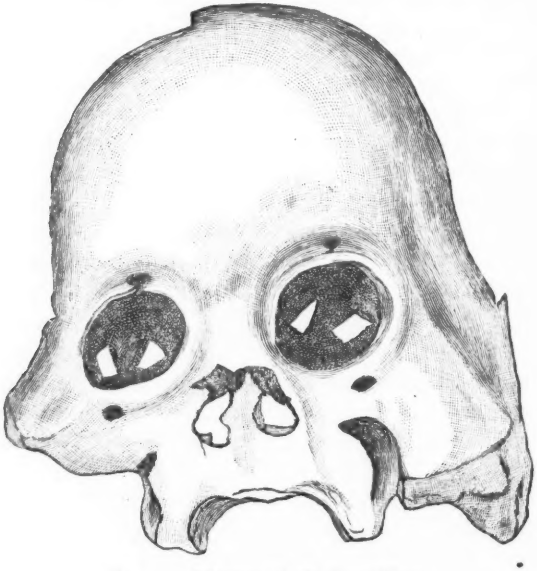

FIG. 1.—Calaveras Skull, Front View.

while, for the instances in which the products of human workmanship have been washed out of the "gravel" in searching for gold are altogether too numerous for record. Very many of them are now in the Museum of the University of California, and very many more were disregarded and lost, for so common did they become during the days of surface mining, that at length the miners paid no attention to them, and they simply went in with the refuse of the workings.

They were almost universally implements of stone, such as mortars, pestles, rude vases or platters, that is, articles which could be used for grinding food, &c., but all rough in workman-

ship and evidently fabricated by people low in the scale of civilization. But such as they are, they show with what appears to be conclusive proof, that they were made before Table mountain lava was erupted, and perhaps long before, for they were also surely made before the auriferous gravels were deposited.

One item comes naturally to our consideration here in the line of confirmation. The auriferous gravels contain abundant remains of plants and animals. Mastodons and elephants appear

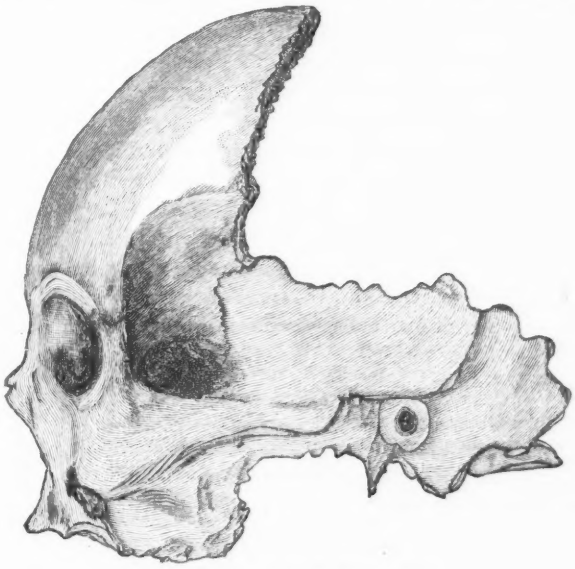

FIG. 2.—Calaveras Skull, Profile View.

to have specially abounded; in no other part of the world have their bones and teeth been found in greater numbers. With them were found species of rhinoceros, Elotherium, horse, ox, camel, &c., &c. But all of these were of types long since passed away, and the same can be said of the leaves and fossilized wood. Dr. Newberry's report characterizes them as being entirely unlike anything now growing in California, and as belonging to the Tertiary age, the later Pliocene. Now we know that the fauna and flora of a country cannot be *completely* changed except through the intervention of a very great space in time, or the agency of a sudden cataclysm and reconstruction.

And shall we now compare them in age with the others which are absolutely prehistoric, and which have disturbed the scientific world by their venerable antiquity. Fierce have been the conflicts waged over the Neanderthal skull, the Engis skull, the men of Cro-Magnon and the various other relics gathered from the gravels and bone-breccias of Europe. But their record is dwarfed to comparative insignificance when laid by the side of that to which we have been looking. The days of Table mountain had passed off into the dark realm of the forgotten past, ages before the drift of the valley of the Somme was deposited or the man of the Neanderthal lived. Those European relics have by none been counted older than the Post-pliocene; these of the Sierra Nevada go back to the Pliocene, and as the "new world" of modern style was the very oldest in showing itself above the waste of waters, so perhaps it was also the first to feel the step of man. It is possible that the discoveries of Ribiero in Portugal, and of the English Geological Survey in India may be found to carry us as far back as the times we have been discussing, but they have thus far been strangely ignored.

What manner of man then was this Ancient Man of Calaveras? Let him speak for himself. All notice of the skull described by Professor Whitney has been purposely omitted till this moment, because it is by far the most important "find" yet made, and it is worthy of being considered by itself and in the present connection. The chief point in estimating its value, is its genuineness. It has been the subject of much criticism, and in the minds of very many, its mention barely recalls Bret Harte's ridiculous doggerel,

> "My name it was Brown, and my crust it was busted
> Falling down a shaft in Calaveras county,"

and the request to send the pieces back to old Mazzoura, has relegated the whole matter to the domain of joke. In the belief that Professor Whitney was the victim of a *sell*, the question is often asked whether there is any evidence that the skull was actually taken from the shaft to which its discovery is credited.

Now with all due submission to previous judgment (or misjudgment), I maintain that that question is of only secondary importance. The skull speaks for itself, and notwithstanding that its lower jaw is gone, it talks good English, whatever its vernacular may have been in the days of the flesh.

That it came to Professor Whitney from the hands of Mr. Mattison (or as I always heard him called, Matthewson), of Angels Camp, is certain. Where did Mr. Matthewson get that skull? I do not know, nor is the precise spot of much consequence. He says he took it from his shaft near what was then called the Forks of the Road, above Angels. Suppose he did, or suppose he foolishly tried to humbug the geologist, what does it matter? He got the skull *somewhere*, and wherever it might have been first found, it surely was imbedded in the auriferous gravel, and it had become so imbedded at the time the gravel was originally deposited.

You say, that is a bold assertion; how do you know it? I will tell you; I know it, because *the skull told me so.* I saw it and examined it carefully at the time when it first reached Professor Whitney's hands. It was not only incrusted with sand and gravel, but its cavities were crowded with the same material; and that material was of a peculiar sort, a sort which I had had occasion to know thoroughly. It was the the common "cement" or "dirt" of the miners; that known in books as the auriferous gravel. This is an article "*sui generis*;" it is not easily imitated. No skill possessed by Mr. Matthewson or any one else could have been sufficient to give the skull the characters which it had as I saw it. It is most certainly no fabrication.

But it has been said that it is a modern skull which had become incrusted after a few years of interment. This assertion, however, is never made by any one knowing the region. The gravel has not the slightest tendency toward an action of that sort. The skull would either decay and waste away, or it would remain unchanged; and added to this comes in the fact that the hollows of the skull were crowded with the solidified and cemented sand, in such a way as they could have been only by its being driven into them in a semi-fluid mass, a condition which the gravels have never had since they were first laid down.

No, no! Let the skull tell its own story, and believe what it says, because it brings its own proof. Whatever age belongs to the gravel deposit under Table mountain belongs to the Calaveras skull, entirely irrespective of the question of honesty or dishonesty in the alleged finder. Wherever he found it, I believe its age to be beyond cavil.

Its degree of fossilization has not been here insisted upon,

because that change is more rapid in some localities than in others, but it is an interesting fact that this Calaveras skull is more thoroughly fossilized, a greater proportion of its phosphate of lime has become carbonate than in either of the European specimens which are reckoned of the greatest age.

We seem then fairly entitled to consider the Ancient Man of Calaveras the oldest representative of our race to which we can as yet refer; and being such, is he of a bestial type? Look for yourself. Figures have been published by Professor Whitney in his work. What is there bestial as shown by them? A single skull cannot, of course, speak for a whole race, but so far as this specimen can testify, what man is now, man was then. It manifests no sign of inferiority to the American race as now existing. Barbarous in habit he doubtless may have been. All the relics of workmanship thus far discovered of those coeval with him, indicate a low grade of civilization, and yet one not necessarily much, if at all, lower than that of most of the Indian tribes which formerly occupied the entire breadth of the continent. And in intellectual power, judging from his cerebral development, he might assuredly have claimed a fair average rank.

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THE GRAY RABBIT (LEPUS SYLVATICUS).

BY SAMUEL LOCKWOOD.

A BIT of odd, yet attractive innocence is the wild rabbit of Europe. I cannot say as much for its descendant, that piebald and lop-eared pet of my boyhood. All endearment died out at sight of the pampered old buck killing his own offspring from sheer wantonness; then came implacable dislike on seeing the doe eating one of her little babies. The domesticated rabbit gains nothing intellectually over its wild ancestor, but becomes emotionally unnatural, if not pathologically unsound. The tamed gray squirrel will lose the sexual instinct to the extent that it becomes degenerated into or absorbed by a morbid appetite so engrossing that the male will suck at one place on the tail of his mate, until he has nearly severed that member. Something not unlike is seen in the stallion of high strain, when biting the neck of the mare in the fervency of his passion. At the best, under domestication, the rabbit, like the guinea pig, *Cavia cobaia*, with its rabbit-like head and face, gets simply coddled into a

stupid harmlessness. In its wild state dwelling in communities, with a living to get, and many foes to shun, the wild rabbit has sharpened wits and many entertaining ways. I have seen them in their warrens abroad, and a rollicking abandon is their early morning frolic. Then all of a sudden comes a still, serious watchfulness, a oneness of circumspection, the whole camp mounting guard, for sitting on his hinder parts, every individual is on the alert. It is light and shade, Milesian merriment topping off with a bit of a row. Let one get its temper up, and it will stamp the ground in pettish, and it may be angry demonstration. All which has in it a spice of high-class nature; for I have seen chimpanzee do the same thing—yes, and coming higher, have painful recollections how a little motherless lad used to quail under a similar plantigrade terrorism, inflicted by Madam Anthropos. So this animal pantomime of "stamping out" is very human.

Though not without cunning, if a ferret invade its domicile, it is all up with bunny, sure. But a terrier dog has been known to squeeze itself into the burrow, and coney, returning to find his home invaded, has with great energy closed up the entrance, thus burying alive the disturber of his peace.

But all this is writing about real rabbits, which is not what we started to do. Perhaps the following occurrence may set our subject in a proper light: A friend had procured an Irish farm-hand at the immigrant depot, at Castle Garden, New York. He brought him to Keyport, New Jersey, by steamboat, then took him in his own vehicle to the farm, some five miles away. William was intelligent and made sensible remarks on the new scenes through which he was riding. Our farmer friend, an inveterate wag, said: "Yes, a fine country, William. But wait till I show you some of our native animals. You have not yet seen an American rabbit." On reaching the first field of the farm a large Spanish stud appeared. Seeing his owner, Sancho approached the fence by the roadside, and brayed a sonorous welcome.

Farmer: "There, William, what do you think of that for an American rabbit?"

William: "An' is that an American rabbit? Sure an' if I'd seen the baste at home I would have pronounced him a jackass! But this *is* a fine country!"

It was not long before the man did make the acquaintance of

our gray rabbit, one which had been caught without harm in a trap. Attempting to toy with it, he received on his hand a smart blow from both hind feet of the affrighted little prisoner, which inflicted quite a scratch, on which he exclaimed: "Sure, Master, 'an is this why you called that ass an American rabbit? Troth, and the little baste does kick like a mule. But I should never take it for a rabbit. At home we would call it a young hare." Probably it would have bothered this sensible man, had he been told that there was in America a hare known as the "great jack-ass rabbit."

Still, William was right every time. The gray rabbit is a hare; and our opening paragraph is applicable only to the true European rabbit, *Lepus cuniculus*. The word rabbit then simply denotes a species of the genus *Lepus*, of which the word *hare* is the generic expression in the English and some of the continental languages. Though possessing several species of hare, America does not include the true rabbit. Passing by certain real distinctions of form, let us notice some striking differences of habit. The cony is a true burrower, and lives in communities. The hare is solitary and, as a rule, does not burrow, though sometimes found occupying an abandoned burrow of some other animal, like the so-called burrowing-owl, *Athene cunicularia*, which occupies the deserted burrows of the prairie dog, *Cynomys ludovicianus*. Then the rabbit, like the guinea pig, brings forth its little ones full-haired and open-eyed; but the young hare comes into being nearly naked and quite blind, altogether a very helpless thing. However, the popular voice has fairly got the start of science in this matter, and as the "gray rabbit" it will be always known. The truth is the systematists got things so badly mixed that not until recently did this very common animal have a scientific name of its own. Peter Kalm, the Swedish botanist, for whom Linne named our beautiful Kalmia, published at Stockholm his Travels in North America, 3 vols., 1753–61. Here is the earliest book allusion to the little hare, and it is referred to as inhabiting New Jersey. But the first carefully-worked-out diagnosis of the species, was made by John David Schoepf, who in 1783 wrote an accurate scientific description of it in New York, which he published the year following in Germany. What is strange and unfortunate, he did not give it a systematic name, but simply called it, "Der Nord-Americanische Haase;" and some of the system-

atists jumped at the conclusion that by "North American Hare," the savant meant *Lepus americanus.* It was some sixty years afterwards when Professor Baird translated Schoepf's description, and said in connection: "It is not a little remarkable, that this, one of the best known animals of North America, should not have received a distinct scientific name until 1837, when Dr. Bachman gave it the name *Lepus sylvaticus*," the wood hare. Other scientists had worked on the case, but, in fatal confusion, had mistaken the individual. Schreber, in 1792, named it *L. nana*, the dwarf hare, a good name, but his description applied to another hare. So it fell out that the only canonic christening the little fellow got, was received of Rev. John Bachman, a collaborator of Audubon. In what follows, the words hare and rabbit will be used interchangeably.

A curious appearance is sometimes noticeable upon the snow after it has lain a few days. The foot-tracks and hard fecal pellets of the rabbit are seen, and close by certain reddish-brown stains, like spots of oxydized blood. These, in mistake, I once explained as probably hæmorrhoids produced by constipation due to the dry fibrous food to which a severe winter reduces the animal, when succulent food cannot be got. This is not the true cause. Something similar is seen in winter when the bees of an apiary, after being snowed-in, are "dug out." The snow around the hives is immediately thickly spotted with small brownish orange stains, Bee keepers call it "bee dysentery." It is simply due to the cleanly habits of the insect. It will not defile the hive, so practices a severe continence until it can get out. In the hard winter of 1880, the hungry rabbits ventured into the gardens of Freehold, N. J., and in a number of places the snow was stained with these bloody spots. It is certainly interesting to know that all this comes of the almost fastidious cleanliness of the animal. Should it find no better shelter in the cold weather, it must occupy its "form," or "bed," that is, its squatting place, into which it pushes its back parts, then flattens itself like a toad in its hole. Thus squatted, such is the resemblance of color to the ground, that the hunter has strode close to the animal's nose and missed it. This form may be a depression in the side of the bank, or under a log, or in a tussock of grass, or in some low, bushy, close-leaved plant. Suppose a snow-storm, and the animal gets "snowed under," there is heat enough to make a little

chamber, and generally a thin breathing spot, or hole, above, caused by the thawing of the warm breath, which unhappily often betrays its hiding place to dog and man. If undisturbed, the animal is so impatient of cold as to stay in its form several days without food. So cleanly is the poor thing, that it will suffer acutely rather than pollute its home; hence the practice of a painful continence until forced by sheer distress to seek relief in a discharge of the suppressed urine. By this time the retained renal secretions have become thickened, and when discharged are of a reddish-brown hue.

The hare of Europe, it is commonly said, never gets fat, unlike other wild animals, even their rabbits, and this no matter how good may be its feeding grounds. Our wood hare does sometimes get quite fat, although it never makes "kidney fat." But confined to its form, as just described, the condition of the animal becomes extremely bad. From long fasting the flesh gets to be very lean, while the retention of the urine infects the entire tissues with urea, making its odor so rank as to receive the epithet "skunky."

The domestic rabbit can be made enormously fat. An epicure not many miles away, often luxuriated on a buck of large size, splendid condition and exquisite flavor. The truth told, it was an eunuch Cuniculus, fat, fair and portly, which graced our gourmand's board. But before leaving the adipose part of this subject, a bit of ignorance must be mentioned, which ought to be unique. Last autumn my neighbor's man captured a fine, gray rabbit. He had skinned the game, and was profuse in praise of its condition; but having opened it, the poor man stood aghast in horror, and was suddenly taken sick, for he beheld in the coney an immense tape-worm! And this horror fell upon the whole family, for they all "saw it with their own eyes." So, not to waste the thing, it was thrown into the stye out of sight. Here was a pearl cast before swine, for the simple fact was, that attached by the edge of a thin membrane to the viscera, along nearly its entire length, was a ribbon of adipose tissue, which was scolloped by little beads of fat. These scollopings were mistaken for "tape-worm joints." In truth, this white, wavy fillet of round, waxen beads was really a very pretty object. Besides, who would look for a Tænia on the outside of the alimentary canal? However, these innocents believed they were right, and

"guessed," dear souls, that "the naturalist wasn't nice enough about his victuals."

Our gray rabbit is often badly tormented with wormals, or worm-holes, in the skin, like the worbles of cattle. These are really subcutaneous bots, due to the presence, under the pelt, of the larvæ of *Cuterebra cuniculi* Clark. Packard speaks of this species of fly infesting rabbits in the South, but they have long been too common in New Jersey. Over the pit occupied by each grub or maggot, is a clean-cut hole through the skin, which serves the larva for a breathing place. They are the most noticeable in the early fall, when the animal is in its best condition; for as the grub or larva feeds on the juices of its host, the mother-fly does not deposit her eggs upon the "ill-favored and lean-fleshed." I am told, however, of a boy who caught a rabbit in the winter, and took it to a friend of mine to skin, and it was too badly infested to be usable. Professor C. V. Riley writes me thus: "I have received the larva of *Cuterebra cuniculi* as early as July 19th. The larvæ were at that time full grown, and pupated four days later. I have also found them, both large and small, as late as September, so there is probably but little uniformity in their development, and it is not particularly strange that they should be found in the larval state in the winter." The hunters say: "The grub leaves after frost." The places specially infested on the animal, are the back and neck, and forward parts of the shoulders. So bad is this at times that a suppuration occurs under the pelt, and an attempt to flay the animal starts the pus flowing, and the loathsome cadaver is cast away. Nor is this flow of maturation to be taken for the effect of wounding the larva by the knife. The skillful dresser of such small game scarcely uses the knife in skinning, except at the head and toes, drawing the pelt off like a stocking.

But the hare family is often the subject of an epidemic. In his grand monograph on the Leporidæ, says J. A. Allen: "In the case of our little wood hare (*L. sylvaticus*), I have repeatedly met with their dead bodies in the woods and thickets, bearing no marks of a violent death, and have noted the scarcity of these animals during the years immediately following." The Indians declare that the hares as a food supply are sometimes seriously reduced by disease. Mr. Allen cites Dr. J. G. Cooper in AMERICAN NATURALIST, who although as against the Indian averment,

and disposed to attribute much of this mortality to the deep snows making them easy prey, says of a certain species: "Their numbers seem never to have increased much, north of the Columbia and Snake rivers since the epidemic (small pox) destroyed them some years since; but south of these rivers they became common." O, shade of Jenner! *Lepus variolus!* What says the epicure to this variety?

The gray rabbit has one form or bed to which it adheres with a cat-like attachment, the runway to which may sometimes be easily traced. If the gunner stations himself near this the game retreating homeward becomes an easy prey. A hunter told me when praising his hound, that by its bark he has distinguished the doubling at half a mile distant, and shot the rabbit at its return; but that an old rabbit, if you miss him, will avoid his "bed," and give you trouble to get him. An old rabbit usually has a series of forms at distances of thirty or forty yards from its favorite one. These supplemental forms it uses for comfort's sake, and for strategic purposes. It dislikes to face the wind, and when in repose keeps its back to windward. With the change of wind, it will change its form. A change may be made upon suspicion of danger; or it may be circumvented when away from its favorite form. Though if the danger be imminent, it usually has some hole in the ground or place under or behind a log, or in a brush-heap, into which it at once retreats. If not taken too suddenly, there is a good deal of intelligence in its methods of flight, as well as in its temporary change of domicile. They do not connect their forms by their tracks, but take prodigious leaps, clearing at a bound from fifteen to twenty feet, and the zig-zags and doublings are well suited to deceive. A curious fact about their tracks might delude the unwary into the belief that they were double, and directed backwards. The hare is virtually a plantigrade, and its leaping is done with its hind legs, much like that of the kangaroo. Upon the soft snow or on the soft ground the spoor, or trail, of a rabbit in full jump comprises two dissimilar pairs of imprints; a pair of small toe-tracks inside, and a pair of large full foot-tracks outside. The series is the impression of successive leaps, which are made in the following way: The two little front feet or hands are put pretty close together, while the hind feet are set somewhat widely apart. The fore feet are then raised from the ground, and the body by the

same act is thrown back so as to bring the entire weight upon the firmly planted hind feet, in which, and in the thighs, and on the back the muscles are powerful, hence comes the tremendous spring. In alighting, the forward feet nearly close together, touch the ground first; then come down the hinder feet, striking outside and forward of the front feet. Thus is made a double track, the large and wide one outside and forward of the small one, like the kangaroo's track, with this singular difference, the latter makes his double tracks walking, for when leaping the fore feet do not touch the ground. These peculiarities of rabbit tracks were noticed by that delightful naturalist, Robert Kennicott, in 1857, who adds: "In making the longest leaps the fore feet strike in a line, one behind the other, and at some distance in the rear of the hind ones, as if they had been again raised before the latter had touched the surface." It is noticeable that when in quest of food on the snow, their tracks are made of leaps about four feet long.

The strategic tact and knowingness of the wild rabbit was well understood by the plantation negroes, who held the little fellow in an affection not less than that of the Feejee for fat missionary. The upper side of the rabbit's tail is brown, but it has a persistence in showing the under side, which is like a toilet puff, cottony white. The tail being ordinarily carried erect, looks like a tuft of pure clean cotton, or a fresh opened cotton ball, hence its familiar name among the negroes—"little cotton tail." Uncle Remus, though partial, always gets fraternal when on this subject, and makes the cunning "brer rabbit" circumvent the slyness of "brer fox."

(To be continued.)

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THE CRUSTACEAN NEBALIA AND ITS FOSSIL ALLIES, REPRESENTING THE ORDER PHYLLOCARIDA.

BY A. S. PACKARD, JR.

I.—The Structure and Development of Nebalia.

A GOOD deal of interest is attached to this little Crustacean, on account of its composite nature and its evident relationship to some curious fossils which are usually placed among the Phyllopods. The following exposition of the structure of *Nebalia bipes*, which is sometimes dredged on our coast, and the remarks on its fossil allies may prove to be of interest to our

readers. The article is taken, by permission, from the advanced sheets of the Twelfth Annual Report of the U. S. Geological Survey of the Territories, F. V. Hayden, in charge.[1]

The species of Nebalia inhabit the sea at moderate depths. We have dredged *N. bipes* on the coast of Labrador in from four to eight fathoms, and on the coast of Puget sound we collected a similar species, just below low-water mark, among fucoids. The following is taken from Baird's British Entomostraca: "Otho Fabricius tells us that it carries its eggs under the thorax during the whole winter; that they *begin to hatch* in the month of April, and that the young are *born* in May. They are very lively, he adds, and adhere to the mother, who appears then to be half dead. The adult swims in a prone state, using its hinder feet to propel it through the water. They are not very active. Montagu informs us that when moving in the water the superior antennæ are in constant motion as well as the abdominal feet, but that the inferior antennæ are usually motionless and brought under the body. They are found, according to Leach, on the south-western and western coasts of England, under stones that lie in the mud, amongst the hollows of the rocks; and Mr. McAndrew dredged it from a considerable depth amongst the Shetland isles."

In *Nebalia bipes* the body is rather slender and somewhat compressed, the anterior half protected by a carapace, beyond the lower edge of which the broad thin phyllopodiform feet do not project.

The carapace.—The head and anterior half of the body, including the thorax and four anterior abdominal segments, are covered by the carapace, which on the lower edge extends below the ends of the thoracic feet, covers the basal joints of the antennæ, and entirely covers the mouth parts. The sides are compressed, and are drawn together over the body by a large but rather weak adductor muscle (Pl. XIV, Fig. 6), situated a little in front of the middle of the thorax. There is no large highly specialized adductor muscle connecting the two sides of the carapace, nor any well-marked round muscular impression in the carapace, such as is characteristic in the Limnadiadæ; nor is there any hinge, a still more characteristic feature in the bivalved Phyllopods. On the contrary, as seen in Pl. XIII, Fig. 3, repre-

[1] I am indebted to Messrs. Sinclair & Son for kindly striking off an edition of the plates from the stones, after the Government edition was printed. To Dr. F. V. Hayden I am indebted for the use of the illustrations.

senting the carapace removed from the body and flattened out, there are no signs of a median hinge-joint.

The nature of the rostrum is one of the diagnostic features of this order. In Nebalia the rostrum is long and narrow, oval, seen from above, terminating in an obtuse point quite far in advance of the head. It is loosely attached to the sinus in the front of the carapace, and thus forms a long, narrow, tongue-like flap, with a free movement up and down. It is thus seen to be rather a movable appendage of the carapace than a solid, immovable continuation of it, as in the Decapoda. Upon removing the carapace and flattening it out, it is seen to be readily comparable with the carapace of Ceratiocaris.

The eyes.—The eyes are mounted upon a stalk, and thus Nebalia may be said to be essentially stalk-eyed. In this respect it is similar to the eye of the Branchipodidæ on the one hand, or to the eye of the Decapoda on the other.

The antennæ.—The two pairs of antennæ are large, well developed, and of nearly equal size in the female, but in the male the second pair extend backward beyond the bases of the caudal appendages. In the 1st pair the stem (scape or protopodite) is seen to be composed of five joints, the 1st, 2d and 4th the longest, the 3d and 5th short. From the scape arises the flagellum or endopodite, which has sixteen well-marked joints, each joint provided externally with numerous setæ; and besides, there arises from the 5th joint of the scape or stem a scale-like unjointed appendage, which may be regarded as an exopodite; if so, then the 1st instead of the 2d antennæ in the Phyllocarida bear a scale-like exopodite; the 2d antennæ in Decapoda bearing the exopodite.

The 2d antennæ have a two-jointed stem or scape (protopodite), and a single, long, many-jointed flagellum or endopodite, the basal joint a large one; no exopodite being present even in a rudimentary form.

The 1st and 2d antennæ are thus seen to be quite unlike those of the Malacostraca, and to resemble those of the Copepods, in that the anterior pair are rather the stouter of the two; but in those Copepods with very long antennæ it should be remembered that they are the 1st and not the 2d pair, as in the male Nebalia. It will thus be seen that while the antennæ of the Phyllocarida are entirely unlike those of the Phyllopoda, they are

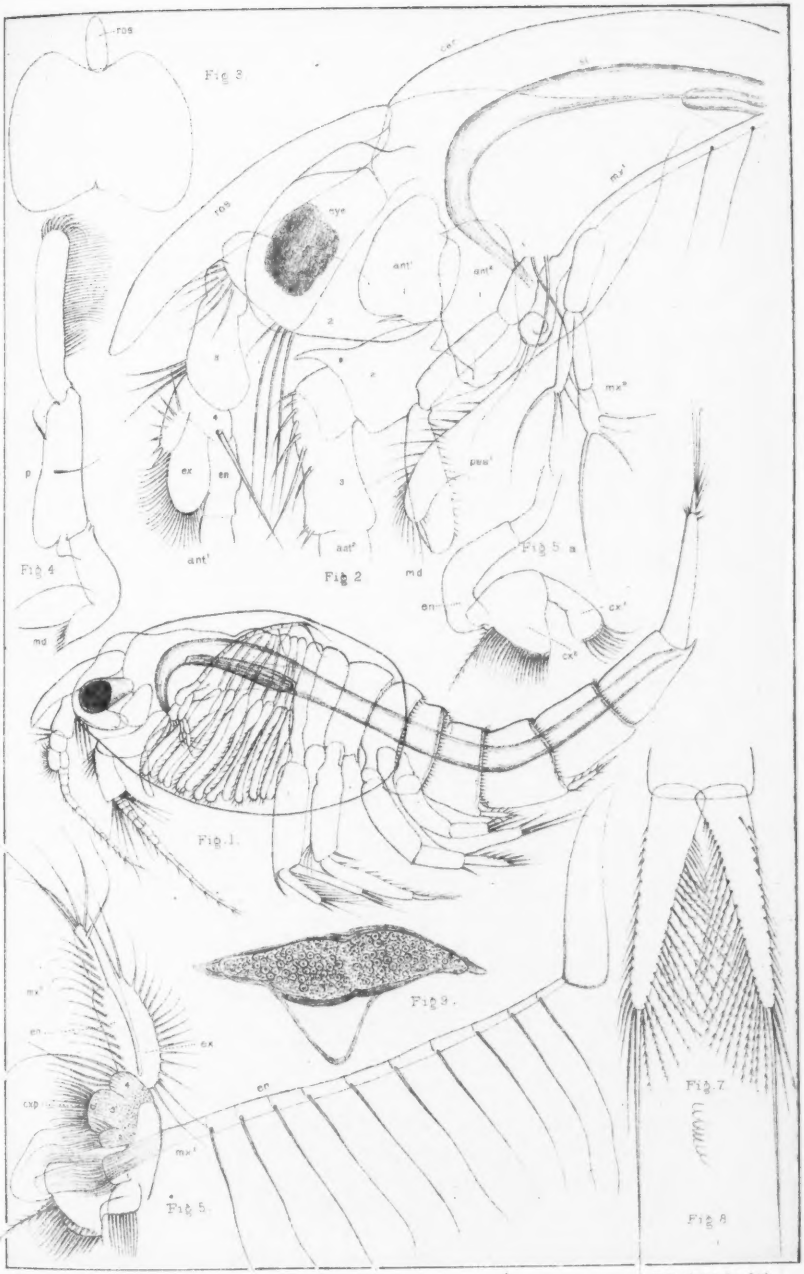
neither closely homologous with those of the Decapoda (Mysis or Cuma) or the Copepoda.

The 2d antennæ of the male is said by Claus to be very long, and to resemble those of male Cumaceæ, but upon a comparison of the stem of the antennæ, it is in Cuma quite different in the relative length of the three joints. So also, while, as Claus observes, they are like the antennæ of the Amphipoda, this resemblance is quite general; on the whole, however, the antennæ of both pair bear a general resemblance to the Malacostracous type; also, on the other hand, they may also be compared with the more primitive Copepodous type.

The mandibles (Pl. XIII, Fig. 4; Fig. 2, *md*).—These are remarkable from the small size and weak development of the biting edge or mandible itself compared with the palpus. The oval or biting end of the protopodite is small, and armed with comparatively few and weak setæ, which shows that the living Phyllocarida probably feed on decaying animal and vegetable food, which is easily brushed into the mouth by their slight stiff bristles. The palpus, however, is enormously developed, extending out quite to, if not a little beyond, the edge of the carapace (Fig. 1). It is three-jointed; the 2d a little longer than the basal, and swollen at the base, while the 3d is somewhat longer but slenderer, and edged with a fringe of close-set, rather stiff setæ. Though so immensely developed as to the palpus, and entirely unlike the mandible of the Phyllopoda, in which only the protopodite is developed, it may be compared with the mandibles of the Decapoda, especially of Mysis and other Schizopods,[1] in which a very long three-jointed palpus is developed. But the very long and large mandibular palpus and very weak protopodite may be set down as a diagnostic feature of the living Phyllocarida, though the mandibles of the fossil species appear to have been much larger.

The 1st Maxilla (Pl. XIII, Fig. 2 mx^1; Fig. 5 mx^1, 5 *a*).—These are likewise singular and diagnostic features of this order, as represented by their structure in the Nebaliadæ. They consist of a small lobe (Fig. 5 *a*, cx^1) with about eight stout setæ, and a larger lobe (cx^2) with the outer edge fringed with long coarse setæ, one of which is a large ciliated seta; from this arises, after bending on itself at its base, an extremely long and slender multiarticulate

[1] Compare G. O. Sars' Monographie over Mysider, 1870, Pl. I, Fig. 8. Claus states that the large palpus is very similar to that of many Amphipoda, but apparently overlooks the still closer resemblance to that of Mysis.



A.S Packard, del.

T. Sinclair's Son, Lith.

ANATOMY OF NEBALIA PIPES.

process (or endopodite?) which, in the female, is directed upward and backward (Fig. 5 *a*, *en*), reaching to the tergum of the basal abdominal segment, and ending in two very long, slender setæ, while a few other similar setæ arise, one from each joint.[1] In the male of *N. geoffroyi*, according to Claus, the long setose process is directed forwards and downwards.

The 2d maxilla (Pl. XIII, Figs. 2, 5 mx^2).—These are entirely unlike those of the first pair, and unlike the Decapodous or Phyllopod type. They consist of a basal portion composed of four thin, delicate, unequal lobes (Fig. 5, $^{1, 2; 3, 4}$), edged with long setæ, with two setæ twice as long as the others arising from the 4th lobe; from this four-lobed basal joint or coxopodite, arise two appendages, the anterior (exopodite, *ex*) small, one-jointed; the posterior (endopodite, *en*) two-jointed, the end of the second joint carrying above five long, spreading, stout, slender setæ This two-jointed appendage Claus considers as representing the stock of a palpus.

This pair of maxillæ are quite unlike those of Decapods (Mysis, etc.), as well as those of the Phyllopods, and appear to be another diagnostic feature of the order.

The absence of any maxillipedes, or of any rudiments of them, either in the adult or in the embryo, is a negative character of a good deal of importance when we regard the affinities of the group to the Decapods, or the zoëa-form of the same order, where two (Macrura) and three (Brachyura) pairs of maxillipedes are present, there being three pairs in the adult Decapod.

The eight pairs of Phyllipodiform thoracic feet (Plate XIV, Fig. 3).—The maxillæ are directly succeeded by eight pairs of leaf-like thoracic feet, the maxillipedes not being present. The feet all repeat each other in form, and a description of the 3d or 4th pair will answer for the 1st as well as the last. The leg (Fig. 3, 3d or 4th pair) consists of a broad, thin, six-jointed appendage, the endopodite (*en*), which is fringed with very long, delicate setæ, those arising from the terminal joint being ciliated; while a second series of fine stiff setæ arise obliquely from the edge. To the second joint of the endopodite are appended a distal or lower very broad thin gill, not quite twice as long as broad, and which reaches to the end of the endopodite, while situated more externally is a double, broad, large lobe which corresponds to the exite

[1] Claus draws attention to the position of this foot as compared with the 2d maxillæ (putzfuss) of the Ostracoda.

or flabellum of the Phyllopod foot, this flabellum being as long as the entire endopodite, but not quite so broad as the gill. The distal portion of the flabellum is more pointed than the proximal, and, as will be seen by referring to the figure, is more actively engaged in the process of respiration. The figure shows by the dotted lines of parenchymatous matter the course taken by the blood in passing through the gill and accessory gill or flabellum, and that it must also be partly aerated by the jointed endopodite; the entire appendage, therefore, as in those of the Branchipodidæ, is concerned in respiration. It will thus be seen that the limb is lamellated, but differs essentially from the Phyllopodous limb in that the endopodite is simple, the axis multiarticulate, but sending off no endopodal lobes from the axites, such as form the characteristic feature of the Phyllopodous foot. From overlooking this important and radical difference from the Phyllopodous foot, the earlier observers were led to place Nebalia among the Phyllopods.

In comparing the thin, lamellar, thoracic foot of Nebalia with the thoracic foot of any Decapod, from Cuma to Mysis, and up through the Macrura to the crabs, it will be found impossible to homologize the parts closely, though a general homology is indicated, the endopodite of the Nebalia and the gills corresponding in a general sense to those of the Decapods, and it is this lack of a homology more than any other which forbids us from regarding the Nebalidæ as entitled to take rank under the order of Decapoda, or with any of the Malacostraca. But when we compare the thoracic legs of the adult Nebalia with the maxillipedes of the zoëa of the Decapods, then we can detect a slight and interesting resemblance, but the resemblance and homology is not so close as between the thoracic legs of the Phyllopods and the maxillæ of the early zoëa.

On comparing the broad lamellate thoracic feet of the adult Nebalia with the rudimentary thoracic feet of the later stages of the zoëa, the resemblance is but slight. Just before the zoëa passes into the adult condition the five pairs of thoracic feet of the adult bend out as two-lobed processes; but the resemblance to the leaf-like foot of Nebalia is too remote to be of any taxonomic value; and this remote resemblance shows that Nebalia does not belong to the Decapod type.

The six pairs of abdominal feet (Plate XIV, Figs. 4, 5).—Turning

to the abdominal feet, we find that they are simple, without gills, and entirely different from the leaf-like thoracic appendages, and we have in this differentiation of true abdominal from the thoracic feet a Malacostracan character, one quite unlike the differentiation or blending of the two regions in the Phyllopods.

The abdomen is nine-jointed, the segments cylindrical and edged with obtuse spines (Pl. XIII, Fig. 8) much as in Copepoda.

In their general form the abdominal legs appear to resemble the simple biramous legs of the Copepoda, but still more closely those of the Amphipoda, in which, as Claus observes, there is a similar retinaculum. (See also Milne-Edwards's Crustacea, Pl. 30, Fig. 3[a].)

The 5th and 6th segments of the abdomen bear much smaller, more rudimentary legs. The 1st pair (Pl. XIV, Fig. 5) are seen to be two-jointed, the 2d joint long and slender, bearing near the end stout raptorial setæ, and on the inner edge slender setæ. The 6th pair are still more rudimentary, one-jointed, and with but few setæ, which are stiff and coarse. These resemble the simple unbranched 5th and last pair of abdominal feet in Copepoda (Calanus ♀).

The long, slender terminal segment bears two very long, narrow cercopods (Pl. XIII, Fig. 7) ending in one large and several small setæ, but there is no telson; the cercopods are simple, the integument entirely smooth, with no striæ or any other markings, and they are edged externally with short, and internally with long ciliated setæ. In the absence of a telson Nebalia differs from Cuma or any other Decapod, and in this respect, and the simple cercopods, shows a close resemblance to the terminal segment with its two setiferous cercopods of the Copepoda.

Internal anatomy.—Claus remarks in his "Untersuchungen zur Erforschung der genealogischen Grundlage des Crustacean-Systems" (1876), that in all the internal systems of organs, Nebalia is considerably removed from the Phyllopoda, and shows an immediate relationship to the Malacostraca, sometimes approaching near the Amphipoda, sometimes near the Mysidæ. The nervous system consists of a large two-lobed brain and of a ventral cord extending through all the limb-bearing segments, there being, as shown in Metschnikoff's Fig. 25 of the embryo, seventeen ganglia, corresponding to the seventeen limb-bearing segments of the body behind the head. A transverse section of a ventral

ganglion of *N. bipes* (Pl. XIII, Fig. 9, or Fig. 1, in text, *ng*) shows a form of ganglion quite unlike that of the Estheria and other Phyllopods, in which the ganglia are separate, connected by rather long transverse commissures, whereas in Nebalia the pair of ganglia are consolidated and of the form of the Decapod ganglion, as also pointed out by Claus, who says that there is a very close resemblance in the form of the nervous centers to the ventral ganglionic chain of the Mysidæ.

We have endeavored to obtain good sections of the brain of *Nebalia bipes*, and Fig. 1 in the text will serve to illustrate tolerably well the form and intimate structure of the supra-œsophageal ganglion. The brain is very small, and the section represented was the third from the front of the head. The ovaries (*ov*) pass into the head, the end of each ovary overlying the brain. The brain itself is composed of two lobes closely united, and seen in section the brain is as deep as broad, with a constriction passing around the outside in the middle. The histological structure is very simple, with nothing approaching the complex nature of the Decapodous brain.

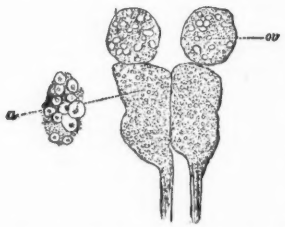
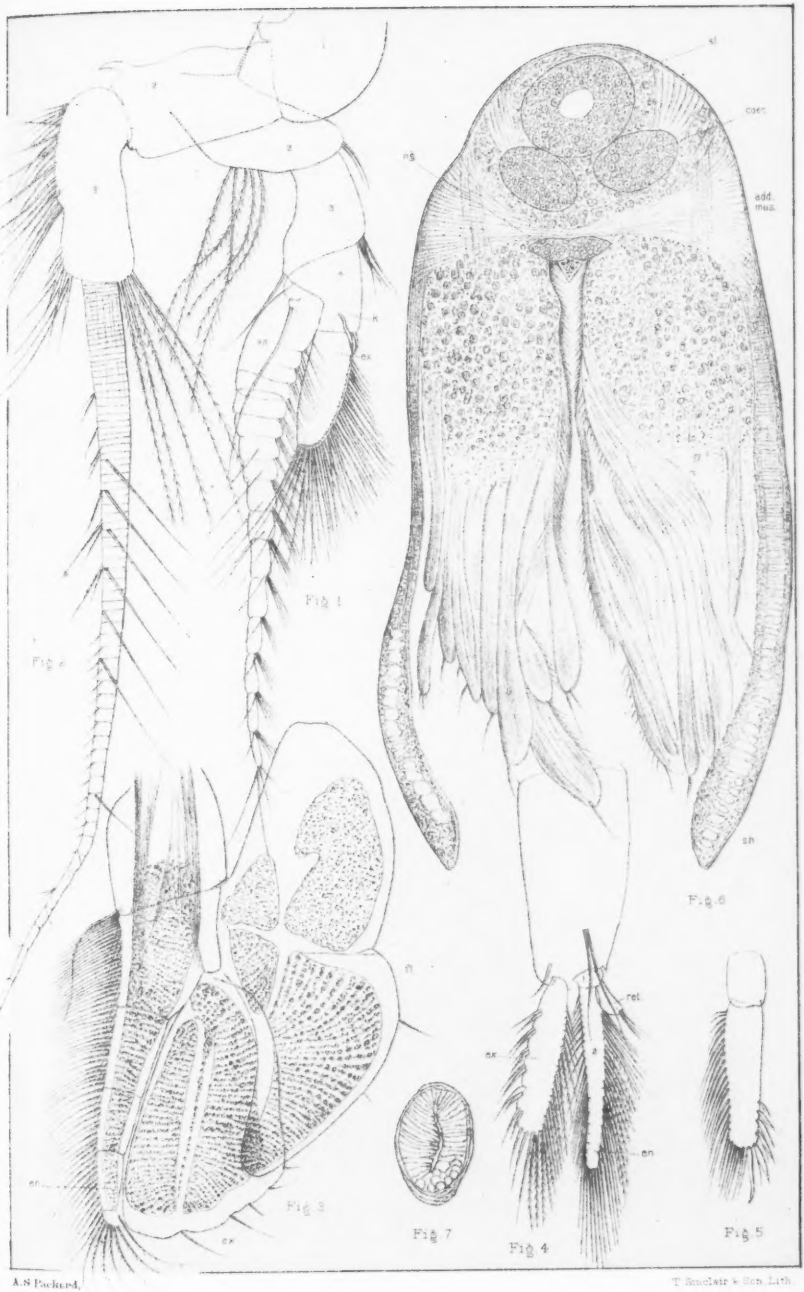


FIG. 1.—Section of the brain of *Nebalia bipes; ov*, ovary; *a*, portion of brain still more enlarged to show the ganglion cells. Author del.

In the digestive canal, says Claus, we have a quite specific peculiarity, together with approximations sometimes to the Amphipoda and Isopoda, and sometimes to the Mysidæ and Podophthalmata. The short up-curved œsophagus leads into a stomach with a complicated chitinous armature, in which an anterior and a posterior division can be distinguished.

Our sections of the body of *Nebalia bipes* show that in their general features the digestive canal and appendages are much as Claus describes for the Mediterranean species. We were unable to get good sections of the proventriculus or *kaumagen*.[1] Plate XIV, Fig. 6, evidently passes through the stomach in front of the heart, which is much larger than the intestine (Fig. 2, *i*, in text). Fig. 2 (in text) is a section (No. 9) through the anterior part of the thorax, in the region of the adductor muscle (*add. m*); the heart (*ht*) is quite remote from the small intestine, which is smaller than the two anterior cœca. In Fig. 3 (in text) of section

[1] Our Sections were kindly made by Mr. Norman N. Mason of Providence, R. I.



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14, through the same specimen at the end of the thorax, the

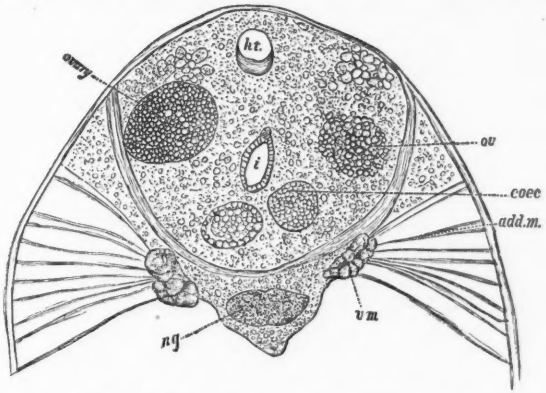

FIG. 2.—Section through the front end of the thorax of *Nebalia bipes*. *ht*, heart; *i*, intestine; *ng*, ganglion; *vm*, ventral muscle. Author, del.

heart (*ht*) is of its maximum size, and now we see sections of six cœcal tubes, the series of four lower ones being the four posterior tubes described by Claus as passing back into the abdomen. In this section the dorsal muscles (*dm*) of the posterior part of the body appear, and the ventral muscles (*vm*) are larger than in section 9, while the ovarian tubes (*ov*) are smaller.

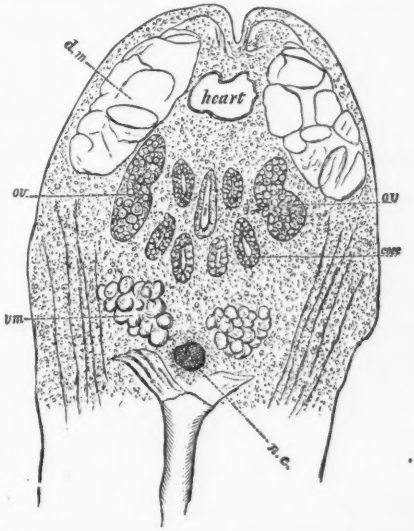

FIG. 3.—Section through the end of thorax of *Nebalia bipes*, showing the six cœca (*cæc*), the heart (*ht*), the ovaries (*ov*), and the sets of muscles; *dm*, dorsal muscles; *vm*, ventral muscles; *nc*, nervous cord; *ov*, ovary; *i*, intestines. Author del.

The heart of Nebalia is a long straight tube a little thicker just in front of the middle, beginning over the maxillæ just in front of the 1st thoracic segment (tergite) and extending to the middle of the 4th abdominal segment.

Claus includes Nebalia among the Malacos-

traca, but when we consider the composite nature of the internal organs as described by him, we wonder that he failed to appreciate the independent, synthetic nature of the Phyllocaridan type which, when we take into account the external as well as internal organization, forbids our regarding Nebalia as a true Malacostracan, though the type of a group standing outside of, but nearer to the Malacostraca than are the Phyllopods.

The development of Nebalia.—Our knowledge of the development of Nebalia is due to the distinguished Russian embryologist, who in 1868 published an elaborate account of the developmental history of *Nebalia geoffroyi.* Unfortunately the pamphlet is in Russian, and only brief abstracts of it have appeared in German. But as ample and well-drawn figures illustrate the work, we can state the salient points in the ontogeny of this interesting Crustacean. The yolk does not undergo total division, but by the subdivision of a large polar cell the yolk becomes surrounded by a layer of blastodermic cells. Soon after the rudiments of the two pairs of antennæ and of the mandibles bud out, the abdomen also being differentiated from the rest of the body (Pl. xv, Fig. 1). This is regarded as representing the free nauplius condition of other Crustacea. At a succeeding stage (Fig. 2) the two pairs of maxillæ and two pairs of thoracic feet bud out; and in a stage immediately succeeding (Fig. 3) the palpus of the mandibles elongates, the maxillæ are two-branched, and seven (or eight) pairs of thoracic feet are indicated. In a succeeding stage (Fig. 4) Nebalian characters assert themselves; such are the carapace and large rostrum, the biramous anterior pair of antennæ, the unbranched 2d pair, the long mandibular palpus, the absence of any rudiments of maxillipedes, and the eight pairs of thoracic feet (bænopoda) and three pairs of abdominal feet (uropoda), all of which are now well developed. At this stage it may be seen that, as in spiders, the 1st pair of thoracic feet may represent the 2d maxillæ of insects transferred from the head to the thorax; so in Nebalia, the three first of the eight pairs of thoracic feet may correspond to the three pairs of maxillipedes of Decapods, which in early life, before the thorax is differentiated from the head, may have remained afterwards as a part of the thorax. An intermediate step is the retention in the Mysidæ of the last pair of maxillipedes or the 1st pair of thoracic feet, so that these Crustacea have six pairs of feet. Moreover, Nebalia

at this time, in the absence of differentiation of the thorax from the abdomen, and of thoracic and abdominal feet, the two sets being similar in form and development to each other, may also represent the Phyllopod stage. In the next stage, at the time Nebalia leaves the brood sac of the mother, it is but one step removed, so to speak, from the adult form.

Metschnikoff's observations were made on *Nebalia geoffroyi* of the Mediterranean sea. We have in our sections of *Nebalia bipes* observed stages of development in the young similar to the stages represented by Metschnikoff's Fig. 13 or 14, and have found in the bottom of the vial in which the specimens were sent, several young which had fallen out of the brood sac of the parent. Upon comparing these with Metschnikoff's Fig. 19, or Fig. 5, Pl. xv, they are of the same form; the rostrum being large, the procephalic lobes large, the eyes small, the stalks not yet developed, while the maxillary palpus stretches back to the 1st abdominal feet; the thoracic feet are covered by the large carapace, and a 4th pair of abdominal feet have developed, while the caudal appendages are as in the adult. In all these features we see only a general resemblance to the Schizopods of any value, the similar earliest phases of development proving of no special importance.

Comparison between the early stages of Nebalia and the Decapod (Schizopod) Mysis.—It would appear that if Nebalia were a Decapod, that in its larval stage it should present a close homology with Schizopods at a similar stage of existence. In Euphausia the young leaves the egg and becomes a free-swimming nauplius, and then a protozoëa, and at length a zoëa larva before assuming the adult condition. It is evident that since Nebalia passes its early stages in the incubatory pouch of the mother, that it should be rather compared with the young, when about ready to leave the mother, of some Mysis-like form.

Happily, Professor G. O. Sars has afforded us the material for such a comparison. The early stages of Mysis, as worked out by Van Beneden and Claparède, and of Nebalia, are much alike; the formation of the blastoderm is much the same. The nauplius stage in the egg is nearly identical in both, but beyond this the parallelism ceases to be an exact one; Nebalia turns off and follows quite a different developmental path from Mysis or any Decapod. If we compare the young of Nebalia, taken from the brood-sac, with that of Mysis, as figured by Claparède (Plate

XVII, Fig. 6), or a more advanced stage, particularly that of *Pseudomma roseum*, as figured by Sars,[1] we shall find that many of the differential characters which, in the adult, separate the Phyllocarida from the Decapoda, are to be found in the young. In Mysis and allies at the same stage as Metschnikoff's Fig. 18 of Nebalia (our Plate XV, Fig. 4), the 2d antennæ are simple instead of being bifid as in Nebalia; there are no maxillipedes, and the maxillæ are, as in the adult, immediately succeeded by the eight pairs of thoracic feet; moreover, there are no abdominal feet in Mysis or Pseudomma, while three pairs are present in the young Nebalia. But with the exception of the lack of abdominal feet in the Mysidæ at this stage, it may be thought upon the whole, as has already been stated by Balfour, that "the development of Nebalia is abbreviated, but from Metschnikoff's figures may be seen to resemble closely that of Mysis. * * * There is in the egg a nauplius stage with three [pairs of] appendages, and subsequently a stage with the zoëa appendages." It seems to us that the comparison[2] here made is, as regards any resemblance to a zoëa, loose and inexact, whether applied to the Mysidæ or to the Phyllocarida. The stage of the Mysidæ succeeding the nauplius is characterized by the presence of the rudiments of eight pairs of appendages, the two pairs of maxillæ, and the six pairs of thoracic feet of the Schizopodous type, while the zoëa has no thoracic feet at all, so that it would appear that the Schizopods do not pass through a genuine zoëa state like that of the higher Decapods. Nor on the other hand is the Nebalia stage represented by Metschnikoff's Fig. 18 (our Fig. 4) a zoëa stage, for the embryo has the rudiments of eight pairs of thoracic feet, and besides those of three pairs of abdominal feet, while there is a well-marked carapace and rostrum, as well as procephalic lobes with eyes, all these parts not being developed in the embryo Mysidæ.

But whatever may be said of the resemblances between Nebalia and the Mysidæ at an early period after the nauplius stage has been discarded, when we compare the later stage represented by Metschnikoff's Fig. 19 (our Fig. 5, Plate XV) with the latest larval stage of Pseudomma (see Sars's Fig. 23, our Plate XV, Fig. 6),

[1] G. O. Sars, Monog. over Mysider, Heft. 1, Taf. IV, Fig. 23.

[2] Claus (Genealog. Gundlage des Crust. Systems, p. 31), as we find since writing the above, does not accept Metschnikoff's comparison of the young Nebalia with the zoëa, although he does not give the reasons for his dissent.

PLATE XV.

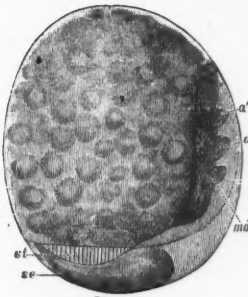

Fig. 1.

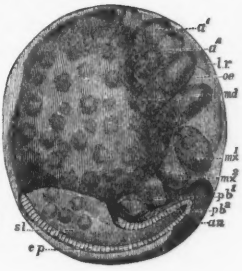

Fig. 2.

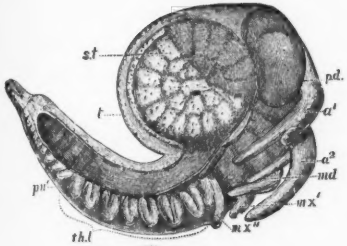

Fig. 3

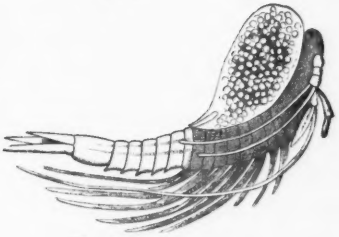

Fig. 6.

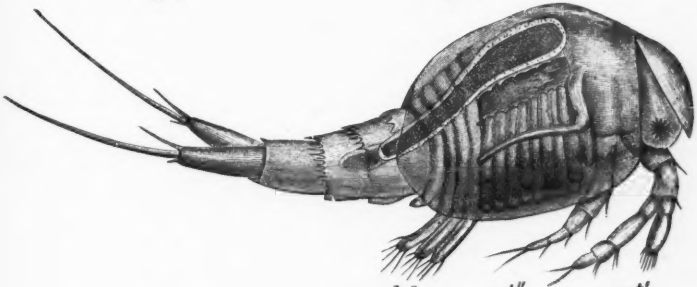

Fig. 5.

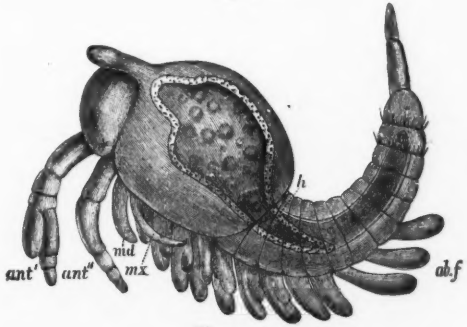

Fig. 4.

THE EMBRYOLOGY OF NEBALIA.

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then we see that the diagnostic ordinal characters of the Phyllocarida have declared themselves. There are to be seen in Nebalia the large movable rostrum, the compressed pseudobivalvular carapace, the lack of maxillipedes, the eight pseudophyllopod thoracic feet, and four pairs of abdominal feet, out of the six of the adult. On the other hand, in Mysis of the same stage, the two pairs of maxillipedes are well developed, and the six pairs of remarkably long thoracic feet (the first pair modified maxillipedes) are present. There is little to indicate that the Schizopods have descended from a Nebalia-like form, but rather from some accelerated zoëa form; while, as we attempt in this essay to show, the Phyllocarida have had no Decapod blood in them, so to speak, but have descended by a separate line from Copepod-like ancestors, and culminated and even began to disappear before any Malacostraca, at least in any numbers, appeared.

EXPLANATION OF PLATE XIII.

FIG. 1.—*Nebalia bipes* Kroyer; female, much enlarged.
" 2.—*Nebalia bipes* Kroyer, female, head; *ros*, rostrum; *car*, carapace; *ant*^{1}, 1st antenna, (1–5) five basal joints; *ex*, exopodite; *en*, endopodite; *ant*^{2}, 2d antenna, with 1–3 three basal joints; *pes*^{1}, part of first pair of feet; *md*, mandible; *mx*^{1}, first maxilla; *mx*^{2}, second maxilla; *st*, stomach.
" 3.—The carapace flattened out to show relations of rostrum.
" 4.—Mandible, *md*, cutting edge; *p*, palpus.
" 5.—The two maxillæ; 1–4, the four lobes of the coxopodite.
" 5*a*.—1st maxilla; *cx*^{1}, *cx*^{2}, coxopodites; *en*, endopodite.
" 6.—(Omitted.)
" 7.—Cercopoda or caudal stylets.
" 8.—Portion of dentate edge of an abdominal segment.
" 9.—Section through a ventral ganglion.

EXPLANATION OF PLATE XIV.

FIG. 1.—*Nebalia bipes* Kr. ♀; 1st antenna; lettering as in Pl. XIII; *k*, lobe from 4th joint.
" 2.—2d antenna.
" 3.—One of the 3d or 4th pair of thoracic feet; *fl*, flabellum; *ex*, exopodite; *en*, endopodite.
" 4.—One of 2d pair of abdominal legs; *ret*, retinaculum; *en*, endopodite; *ex*, exopodite.
" 5.—One of the fifth pair of abdominal feet.
" 6.—Section through the body just behind the first pair of thoracic feet, through the stomach (*st*), and the two anterior cœca (*cæc*); *add. mus*, adductor muscle; *sh*, shell.
" 7.—Section through one of the cœca.

EXPLANATION OF PLATE XV.

FIG. 1.—Nauplius stage of *Nebalia geoffroyi*.
" 2.—Farther advanced embryo.
" 3.—Still older stage, with the thoracic feet.
" 4.—Advanced embryo.
" 5.—Embryo ready to hatch.
" 6.—Embryo of Pseudomma about ready to hatch. (After Sars.)

Figs. 1–5 copied from Metschnikoff.

AMERICAN WORK ON RECENT MOLLUSCA IN 1881.

BY WILLIAM H. DALL.

SINCE the appearance of our last record (1880), death has claimed Mr. Chas. M. Wheatley, of Phœnixville, Pennsylvania, who was formerly noted for his interest in fresh-water shells, and for whom several American species have been named. He did little original work in this field, but in geology and palæontology, especially the exploration of certain bone-bearing caves, his contributions to science have been gratefully recognized.

The recorder would renew his request to authors to furnish him, as promptly as practicable, with separate copies of their publications on recent mollusks,[1] in order that the completion of this record may be made as early in the succeeding year as possible, and he would also suggest to writers not resident in America that any papers bearing on American mollusca or especially interesting for any reason to American malacologists, will, if copies are furnished, be duly noted in the record.

The year shows a creditable amount of work done, and is especially notable for the investigations into the mollusks of the deep sea (of which Pleurotomaria is not the least interesting); the contributions to our knowledge of the Cephalopoda of our eastern coast; and the researches into the egg and early stages of *Limax campestris* and the generalizations resulting therefrom.

An account of recent progress in zoölogy for the years 1879 and 1880, by Dr. Theo. Gill, appears in the Smithsonian Report for 1880, separate advance copies being issued in 1881. It contains a résumé of the more remarkable advances in our knowledge of mollusks during the period mentioned. We are informed that similar reports may be hoped for annually hereafter in the Smithsonian Report on various subjects and by several hands.

General works.—Mr. Tryon's Manual of Conchology has completed its third volume in 1881 covering the Tritonidæ, Fusidæ and Buccinidæ. When, in 1879, this work was announced, it was stated that it was proposed "to compile a conchological manual which while more comprehensive than any similar work hitherto published, shall be so condensed in text and illustration that it may be issued at a much more moderate price. It will include in systematic order the diagnoses of all the genera and

[1] Which may be sent care of the Smithsonian Institution, Washington, D. C.

higher divisions of the mollusca, both recent and fossil, and the descriptions and figures of all the recent species," etc., etc. We have hitherto refrained from comment upon the manner in which the performance compares with the promises above quoted from the second page of the cover. This, both from our wholly friendly feeling towards the industrious author, and from the hope that as the work advanced, the quality of it (once off unfamiliar ground like the Cephalopods) might improve. The fourth volume has now begun to appear, and it seems to us that it is time to vindicate malacology in this country from the reproach of quietly accepting such a work as this as a praiseworthy or representative product of American science.

The work is an utter failure if we judge it by its own prospectus. In the plain edition the figures are largely unidentifiable. In the (very badly) colored edition they are somewhat more recognizable, though we had not realized that so many blue and crimson gasteropods existed as are there depicted. The expense so far for a bound copy would be about $65, a sum sufficient to obtain quite a little library in itself, and at this rate the claim of a "moderate price" is quite unjustified. There is not a figure in the entire work, so far, by which it would be possible to discriminate between critical species, several of the figures are wrongly numbered, the "descriptions" are inadequate to a painful degree, and contain, in many cases, no diagnostic characters. Were diagnoses of "all the genera" of recent and fossil mollusks really furnished, even if merely copied from the originals without confirmation, the work would still be valuable, but that this is not the case in the families treated, can be determined by any reader.

In general, an uncharitable critic might be disposed to say that the author, when he found a species of which he could not copy a figure, "lumped" it with that which he "guessed" was nearest like it, or if he could not identify it with anything in the collection at Philadelphia, he catalogued it with the "spurious" species. We do not assert that Mr. Tryon has done anything of this kind, but we do assert that the results of his work, in whatever way he arrived at them, are little better than they would have been in the above hypothetical case.

Little care or research seems to have been devoted either to hunting up the locality where species not in the monographs were described or in figuring unfigured species which were easily

within the author's reach. Indeed, we have noticed, so far, but one original figure in the whole work, though there may be more. Of a species described in the Proceedings (1865, p. 64) of his own society, the Philadelphia Academy of Natural Sciences, and of which the type is accessible to all students in the National Museum at Washington, but a few hours away from his home, Mr. Tryon says, "no diagnosis of this species has been published, it is merely mentioned in Carpenter's 2d Report, and figured in Küster from a drawing furnished by W. H. Dall." This "drawing" was one of the plates of Alaska mollusks distributed by the writer in 1879, but of which the text is still in MS. owing to uncontrollable circumstances.

The merits of the work are those pertaining to any catalogue which brings together scattered material, and would have been greater had not an illjudged attempt been made to combine species not autoptically known to the author, and of the distinctness of which he could not therefore speak with authority. It certainly will not be, to a student requiring a real "manual" of the subject, comparable in value to works like Bronn and Keferstein's Malacozoa, for instance, and others of which the combined cost would be less than that of the few parts of Mr. Tryon's work already issued.

It is somewhat refreshing to turn from the preceding work to another, which though not American in authorship or publication, is nevertheless of so much importance to American, as well as other students of malacology as to render its mention here not inappropriate. I refer to Dr. Paul Fischer's Manuel de Conchyliologie (Paris, F. Savy, 1881–2, fasc.1–4. To contain six or seven fasciculi of seven signatures each, 400 cuts in the text and 24 plates with 600 figures), of which (to May, 1882) four parts have appeared. The subscription (payable in advance) for the whole work, is twenty-four francs. The typographical execution is of excellent quality, the illustrations in the text clear, and many of them new; the form, medium octavo, is convenient; and of the execution so far, more need not be said than that it is promptly up to date in matters of research, and in every way worthy of its distinguished author.

"Common Sea Shells of California," by Josiah Keep, A.M., Alameda, Cal. This little work prepared and published by its author, a teacher in the Alameda High School, contains sixty-four pages

of text and sixteen plates, figuring ninety-five species of Californian shells, which are described in a conversational way in the text. Little is said of systematic classification, and wisely so. As it is, the book is well suited to assist the young to a knowledge of the names and more obvious characters of the shells they are likely to find on the shore, and to interest them in the general subject. The figures are very characteristic and in many cases unusually good.

The draughtsman with some instruction would evidently do better work than is common. But we trust that, should Mr. Keep issue a larger work, as it has been hinted he would do, and his present draughtsman should assist, the latter will examine some standard works (like Adams' Genera, for instance) and observe that the axis of the spire should be kept at right angles to the line of sight, by which the foreshortening and distortion which spoil some of his figures of Gastropods (*e. g.* Pl. VI, Figs. 4, 6, 7; Pl. VII, Figs. 1, 2) will be entirely avoided. This criticism excepted, we cordially welcome the little book, which can be obtained of the author himself for the price of one dollar, by those who wish to encourage such enterprise.

Anatomy, Physiology and Development.—The most important work in this department which has appeared during the past year is that on the "Maturation, fecundation and segmentation of *Limax campestris* Binney," by E. L. Mark (Bull. Mus. Comp. Zoöl., VI, No. 12, 8vo, pp. 173–625, Pl. I–V, Oct., 1881). This paper, according to a note by the author, was prepared early in 1879, though its publication has been long delayed, and has already been noticed in the NATURALIST. Its length and character forbid any attempt at analyzing it in detail here. This is the less to be regretted, since those who are in a position to profit by the observations and deductions therein set forth, will by no means fail to inform themselves from the original, while any attempt to condense for others the deductions from such investigations, could hardly result in an adequate representation of the author's position. The work, in execution and presentation, is creditable to American science and to the author, and will form, we hope, merely a beginning of his achievements in this direction.

A reference was made in the record for 1880 (p. 709) to Professor Alpheus Hyatt's lecture on the "Transformation of Planorbis at Steinheim." In the Proceedings of the Am. Assoc. Adv. Sci-

ence (vol. XXIX, Boston meeting) published June, 1881, is a combination of an abstract of the lecture, together with "remarks upon the effects of gravity upon the forms of shells and animals (pp. 1–24, Pl. I–II, separate copies). In this extremely suggestive paper, Professor Hyatt, after discussing the particular case of the Steinheim Planorbis, strives to "bring into comprehensible shape the following conceptions." The conceptions are chiefly to the effect that the unsymmetrical spirality of most gasteropod shells is due to the effects of gravity transmitted by heredity. That many locally constant characteristics are due solely to the physical influences of the environment. That natural selection does not explain these relations, but only serves to fix the results and bring them within the reach of heredity, when they may be inherited according to the law of heredity with acceleration. That gravity appears to be one of the causes of the differences in effort, function and anatomy observed between various parts of animal forms when laterally or vertically considered. That the bilateral or *geomalic* (the tendency to equalize the form in direction of a horizontal plane) growth of organs or organisms appear to be directly or indirectly responses to the demands of gravity. Lastly, that the origin of the limbs in pairs, while mere buds, perhaps, may be the results of attempt at maintaining equipoise by geomalic growth in obedience to the laws of gravity.

That this effect of gravity is marked in animals which become permanently and immovably fixed, like the oyster (and only after they become attached) Professor Hyatt shows to be the case in many instances, and that he has suggested an hitherto overlooked *vera causa* there seems to be no doubt; though its effect in modifying, for instance, the cone of molluscan shells, seems less likely than that the inevitable divergencies from a true cone produced by the physical necessities of the environment, in perhaps a majority of cases, were seized on by natural selection on account of the advantages gained by economy in material, in space occupied, strength resulting and protection insured to delicate internal organs by the spirality of the shell. Supposing all conchifers to be born with a straight conical shell, it is self-evident that unless the creatures were pelagic or very sedentary, that fractures and unequal developments of the margin of the cone would be the case in a majority of individuals. That in fact the conical form would be a decided disadvantage to any creature which had

to travel for its living. That every divergence from a true cone would be an advantage and would lead to hereditary retention or repetition of the divergence, and that spirality (as we know) must necessarily result from any deviation from the straight cone whether due to a mere accidental fracture or any other cause. Knowing this and knowing that in most active mollusks gravity could not act in the same way and direction for five minutes at a time, owing to their changes of position, it does not seem that there is any need of it to account for the development of the spiral in the shells of free gasteropod mollusks.

But whatever view may be taken of single details, Professor Hyatt's paper possesses, like most of his writings, the invaluable quality of arousing discussion, exciting interest and of suggesting new lines of thought; and of such essays we cannot have too many.

Although first printed in the *Quarterly Journal of Microscopical Science* (London, 1881) and the result of studies by a native of Japan, K. Mitsukuri's paper "On the structure and significance of some aberrant forms of lamellibranchiate gills" (Studies from the Biological Laboratory, Johns Hopkins University, II, No. 2, pp. 257–270, Pl. XIX, Mar., 1882) may be considered as in one sense American work, since it was done at the laboratory of an American university and under the instruction and direction of Professor W. K. Brooks. The author here considers the structure of the gills of Nucula and Yoldia and their relation to the gills of other acephalous mollusks. He arrives at the general conclusion that the Lamellibranchiate gill was perhaps originally a simple ridge on the side of the body, but to increase the surface of contact with the water, folds may have arisen on two sides of this ridge. If this be true, Nucula and Yoldia have advanced so far as the gills are concerned, but very little beyond the primitive condition. In course of time, however, as some forms of Acephala became less capable of extensive locomotion, these folds were perhaps prolonged to form tentacular filaments, from which were finally evolved complex gill structures like those of Mytilus, Unio and Ostrea, which took on other functions than respiration, such as assisting in the food supply by means of the currents generated by their cilia. Between the simple gills of Nucula and the complex ones of Unio, there are many intermediate stages with modifications in different directions.

In considering these views it should be borne in mind that the gills (especially in Gasteropods) are almost purely epithelial structures, and therefore especially liable to modification; in most cases they hardly exist in the embryonic stages. As regards the correlation of inactivity with a high type of gill structure, it is perhaps doubtful how far this will bear inspection. Yoldia is extremely active, but is almost like the sedentary Nucula in its gills: Unio which has, according to Mitsukuri, highly specialized gills, is, probably, in many cases nearly as active as Yoldia. Cardium and Pecten are remarkable for their activity, and have highly developed gills, as also have Scintilla and Lepton, which move about almost like Gasteropods.

Whatever be the fate of incidental speculations of the author, the paper is most suggestive and interesting, and may be taken as an intimation of what is in store for malacology when the embryologist and anatomists shall join forces and carry their investigations from the young stages to the fully developed adult form with greater continuity than appears to be the rule at present.

Report of the Commissioners of Fisheries of Maryland, Jan., 1880 (8vo, pp. LXXVIII, 1 l. unp., 269, 8; and 16 plates and sections), Annapolis, State printers, 1880.

Report of T. B. Ferguson, a commissioner of fisheries [for the western shore] of Maryland, Jan., 1881, 8vo, Hagerstown, Bell & Co., 1881 (pp. CXIV, 152, 6; and 18 plates besides cuts in the text).

The contents of the first report were alluded to by the recorder in his summary for 1881, but not having been procurable by him until a late date, exact references to its contents are now added. The appendix contains the account of the "Development of the American Oyster," by Dr. W. K. Brooks, which occupies pp. 1–102, with ten plates; "Extracts from the Report of Master Francis Winslow, U.S.N., made to C. P. Patterson, superintendent coast and geodetic survey, of investigations of the oyster beds in Tangier and Pocamoke sounds and parts of Chesapeake bay, 1878–9," comprising pp. 103–219, with four sections, and lastly, a compend of the "Oyster laws," which, it is alleged by disinterested parties, are never enforced except against non-residents, and hence are practically a dead letter.

The second report is made by Major Ferguson, on the Fisheries-work which came under his own supervision, the State law

allotting one commissioner each to the eastern and western shores. The report itself relates chiefly to vertebrate fisheries, but the appendix is devoted entirely to invertebrates and further "Oyster laws" are included in the compendium which closes the volume.

The appendix consists of (1) an Account of experiments in oyster culture, by John A. Ryder; (2) an Account of an experiment in artificially fertilizing the ova of the European oyster, by Master Francis Winslow, U.S.N. (referred to in this record for 1880); (3) a Bibliography of literature (38 entries) relating to oyster culture; and (4) Notes on some of the early stages of development of the clam or mananose (*Mya arenaria* L.) by John A. Ryder.

The first paper contains an account of the anatomy of the oyster, with illustrative diagrams. Several points are developed more fully than has been done by previous writers; the author's attention is, however, chiefly directed toward the digestive, reproductive and respiratory tracts, and the account does not claim to be by any means complete. The pedal (?) muscles are not noted, an omission characteristic of most papers on the oyster. It is concluded that the oyster is dicœcious. The "fat" of the oyster is not fat at all, but though containing some oil globules, is a deposit of delicate protoplasm, easily digestible and nutritious, which is almost wanting in breeding oysters, which are, therefore, far less desirable as food. The food of the Chesapeake oyster is discussed, and an instance is mentioned where a Pinnotheres with eggs was found established in the shell of an oyster upon which again were attached numbers of Vibriones and Zoöthamnium colonies, whose increase, in all probability, formed part of the food supply of the mollusk, so that host and messmate were mutually benefited. The fauna of the oyster beds is enumerated, with many notes on the various species mentioned. There are but few mollusks, including the "soft-shell clam" (Mya); a species of Modiola; *Xylotrya fimbriata* which rapidly destroys the woodwork of hatching boxes, etc; *Solecurtus gibbus; Crepidula glauca; Litorina irrorata; Urosalpinx cinereus*, the "drill" or oyster borer; and some small gasteropods (probably in part Astyris and Cerithiopsis), including some nudibranchiates. The artificial fertilization of the ova is then treated of and is undoubtedly practicable, but the further preservation of the embryo oysters has so far

failed entirely on account of their minute size, and in spite of the sanguine hopes expressed by Messrs. Ryder and Brooks, there does not appear to us to be any reasonable prospect of success in the project except at an expense which would in practice prove prohibitory. Mr. Ryder also gives figures of young oysters of known age, which illustrated the greater energy and extent of growth in the American (*O. virginiana*) as compared with the European (*O. edulis*) oyster.

The second paper was noticed in this record for 1880, and in view of possible doubts as to the species of oyster observed upon, it is desirable that the experiment should be repeated with undoubted *O. edulis*. It is really surprising that, with their facilities, the European naturalists have hitherto failed to give us a comprehensive monograph of one of the commonest and perhaps the best known mollusk in the world.

The name "clam" in America is commonly applied to any bivalves not "mussels" or "cockles." In New England the clam is *Mya arenaria*, in New York it is *Venus mercenaria*. In the former region the Venus is known as the "hard" or "round" clam; in the latter the Mya is called "soft shell" or "longneck" clam. The name "mananose" is a southern appellation for the Mya, perhaps of Indian origin. Mr. Ryder's observations on the early stages of Mya are full of interest. This mollusk spawns in September and October during a period of about forty days. It is diœcious. The changes in the egg succeed each other with considerable rapidity, and as in the development of the oyster there are marked periods of active change of form which alternate with periods of repose. Bilateral symmetry is marked. The eggs are about $\frac{1}{200}$ inch in diameter. Their segmentation, as far as followed, resembled that of Anodonta, and the gastrula stage is formed in the same way as in the oyster.

A portion of a letter from Mr. Henry Hemphill, of California, relating to variations due to station, in the genus Acmæa appears in Proc. Acad. Nat. Sci. Phil., 1881, pp. 87–8, in which the identity of the so-called *Nacella instabilis* Gld., with *Acmæa pelta* Esch., is claimed. The recorder showed long since that the "Nacellæ" of Carpenter's lists were all referable to Acmæa except one, which is an Anisomyon belonging to the Siphonariidæ. If an examination of the soft parts confirms Mr. Hemphill's views, it will be a very striking illustration of the influence of food and station on external characters.

"Observations on Planorbis" (Proc. Acad. Nat. Sci. Phil., 1881, pp. 92–110), by Dr. R. E. C. Stearns, discusses several interesting questions, such as "Are the shells of Planorbis dextral or sinistral?" He finds most of the species examined sinistral, others dextral and occasionally the same species may be coiled either way. Certain aspects of variation in American Planorbes are considered and pregnant suggestions made. The paper is well illustrated.

An abstract of a paper by Professor E. S. Morse, on changes in the proportions of Mya and Lunatia since the Indian shell-mound period (if such an expression may be permitted when the mounds were probably added to continuously up to the historic period), appears on p. 323, Am. Journ. Sci., XXII, Oct., 1881, and an erratum to the same on p. 415. Professor Morse, as in Japanese shell-heaps, believes he has found good evidence of a change in the proportions of these shells in the differences between the average measurements of a large number of specimens from the shell-heaps on the one hand, and from the present shore on the other. While there seems no reason why such a change may not have taken place, it is still evident that the satisfactory demonstration of the proposition is beset with no little difficulty. The original paper was read before the Cincinnati meeting of the American Association for the Advancement of Science, in August, 1881.

S. P. Robins has an article on "Natural selection and the ink bag of dibranchiate Cephalopods," in the *Canadian Naturalist* (IX, No. 9, pp. 414–420, Dec. 29, 1880), containing some speculations on this subject.

Minot has, in the *Journal of Otology* for 1881, an article in which the available information on the otoliths of mollusks is brought together, but the recorder has not seen a copy of it.

Abyssal mollusks, faunal and descriptive papers. — The mollusks of the deep sea have recently attracted considerable attention. Owing to their peculiar relations to the faunæ of other shores, the deep-sea animals have some right to be considered under a separate head. Those of the Gulf of Mexico and the Caribbean sea, dredged by the *Blake*, form the subject of a "Preliminary report on the Mollusca," by W. H. Dall (Bull. Mus. Comp. Zoöl., IX, No. 2, pp. 33–144, July to December, 1881). To secure priority, advance sheets of each signature were sent to all

those most interested, and the work has benefited in several cases by the criticism and information thus elicited before its completion. The following new genera or subgenera are proposed: Ancistrosyrinx, Bathymophila, Callogaza, Fluxina, Microgaza, Neilonella and Turcicula. The family Pleurotomariidæ is defined from observations on the soft parts. About 150 new species are described, many of which are liable to turn up or have turned up in far distant regions. The genus Macrodon Lycett, hitherto known as a fossil, furnishes a minute representative to the list. The most numerous additions are in the Solenoconcha, Pleurotomidæ, Trochidæ, Marginellidæ and the genera Triforis, Neæra, Leda and various opisthobranchiate groups. Among the latter, *Atys? bathymophila* (l. c. p. 98) has since proved to belong to the (fossil) genus Sabalia. The synonymy of the genus Puncturella; of Pleurotomaria (which is shown to be quotable as of Sowerby, not, as usually, of Defrance); of Crepidula and of Gouldia, is worked out. The latter is shown to be tenable as well as the specific names given by Professor C. B. Adams, in spite of a contrary opinion which had been expressed by Mr. E. A. Smith, of the British Museum, who had in his excellent review of the genus, omitted to observe that the portions of D'Orbigny's Mollusques de Cubá, in which his species of Gouldia (Adams) were published, dates from later than 1846 (probably 1853); unlike the earlier part, of which advance sheets were issued in 1841–2. The little Crassatellas, with which American conchologists are more familiar under the name of Gouldia (like "*Gouldia*" *mactracea*) than they are with the more tropical type of the genus (*G. cerina* Ad.), are hardly separated by any definite characters from the typical Crassatella, though they were called Eriphyla by Gabb.

It may be well to call attention to the necessity for circumspection in describing these deep-water forms on which naturalists are working in several countries, to point out that at least two of the writer's species of Neæra, *N. limatula* and *lamellifera*, have been redescribed subsequently as *N. contracta* and *N. semistrigosa*, by Dr. Jeffreys, who, however, atones for his synonymy by some excellent figures. *Modiola lutea* (Jeffr. MS.) Fischer (Journ. de Conchyl., Jan., 1882), is without doubt identical with *Modiola polita* V. and S. The wide range of many of these deep-sea forms and their existence in a fossil state in Italian and Sicilian

Tertiaries, render the work of identification and determination of new forms peculiarly difficult, and the writer himself may doubtless have erred, unintentionally, in taking for new what may, hereafter, be found already described. For all corrections or emendations he will be very grateful. A considerable number still remain to be worked up, of which several will doubtless prove new. There were no new brachiopods in the Agassiz-Sigsbee collection, but in the Agassiz-Bartlett dredgings of the following year there seem to be several, of which a fine Terebratula, larger and more elongated than *T. vitrea*, with a strong, squarely flexed anterior margin, relatively small appressed apex, and a loop shaped much like that of *T. sphenoidea* Ph., is proposed to be called *T. bartlettii*, in honor of Commander Bartlett, U.S.N., its discoverer in the deep waters of the Antilles. All the new species will be illustrated in the final report now in preparation.

" Notice of the remarkable marine fauna occupying the outer banks off the southern coast of New England " (No. 2), by E. A. Verrill (*Am. Jour. Sci.*, XXII, Oct., 1881, pp. 292–303). In this paper, a continuation of others heretofore mentioned, Professor Verrill gives the details in regard to a number of stations at which deep-sea dredgings were made by the *Fishhawk* in 1880 and 1881, a list of fishes obtained and notes on the more interesting mollusca. In a note Moroteuthis, n. g., is proposed with *Lestoteuthis (?) robusta* (Dall) V., from the North Pacific, as type. The following new species are described: *Issa ramosa* Verrill and Emerton, *Pholadomya arata* Verrill and Smith, *Mytilimeria flexuosa* Verrill and Smith, *Diplodonta turgida* V. and S., and *Dolium bairdii* V. and S. The latter was also obtained by the Blake expedition in deep water off the Antilles, and is closely allied to a small deep-water Mediterranean species, *D. crosseanum* Monterosato.

" Report on the Cephalopods [of the *Blake* expedition], (etc.)," by A. E. Verrill, (Bull. Mus. Comp. Zoöl., VIII, pp. 99–116, 8 pl., March, 1881.) This paper includes figures and descriptions of eight species of cephalopods supposed to be already known, together with *Mastigoteuthis agassizii* V. g. et sp. n., and *Eledone verrucosa*, sp. n. The figures are admirable, the text is revised in the second part of Professor Verrill's " Cephalopods of the N. E. coast of America," elsewhere noticed, which should be consulted for some changes in the nomenclature here used.

Intimately related to the material forming the subject of the foregoing papers, is that treated of in a paper "On certain Limpets and Chitons from the the deep waters off the eastern coast of the United States" (Proc. U. S. Nat. Mus., 1881, pp. 400–414), by W. H. Dall. Certain very ordinary-looking little limpets from deep water were kindly submitted to the author by Professor Verrill, together with specimens of his *Lepetella tubicola.* The examination showed that these forms were of the highest interest, and belonged to two orders, Rhiphidoglossa and Docoglossa, most of the species appearing to be blind. Of the former group there were three species belonging to two genera, both nearer to each other than to any described genus of the order, but differing so much as to necessitate their separation into distinct families which are described as follows: Family Cocculinidæ Dall, containing the genus Cocculina Dall, with the two new species, *C. rathbuni* and *C. beanii.* The dentition closely resembles that of Parmophorus and Helicina, and indicates a relation of this family to the following one, such as in the Pulmonata is sustained by the Cyclostomacea to the Cyclotacea as defined by Troschel. The internal and external anatomy present a curious mingling of features supposed to be characteristic of the Docoglossa and Rhiphidoglossa. The second family, Addisoniidæ Dall, includes the genus Addisonia with the new species *A. paradoxa.* This has a remarkable shell resembling Pilidium Midd. (Capulacmæa Sars). It, or closely allied species, has been described from the Mediterranean, under the name of *Gadinia excentrica* Tiberi, but it has no relations with Gadinia. The soft parts are crowded to one side to make room for a curiously exaggerated gill or rather series of branchial leaflets. The dentition is different from anything hitherto recorded in the Rhiphidoglossa, showing Docoglossal features, while the remainder of the anatomy is less like the true limpets than that of Cocculina. Among the Docoglossa the characters of Lepetella Verrill are determined. It presents certain peculiarities and, for the group, a very abnormal dentition, which have led the writer to separate it in a distinct subfamily, Lepetellinæ from Lepeta, etc. *Pectinodonta arcuata,* n. g. et sp., is proposed for a curious form allied to Scutellina, blind and with a dentition composed of one large pectinate lateral on each side of the median line. The writer suggests that the peculiarities of the Docoglossal dentition

may perhaps best be accounted for by conceding to the group a normal dentition of $\frac{1}{3\,(3.3)\,3}$ which by consolidation or suppression of teeth would cover all the forms yet investigated.

The species of Chitonidæ found in deep water on the American coast are enumerated, and the paper[1] concludes with a scheme of classification of the Docoglossa brought up to date from that proposed by the writer twelve years previously.

(To be continued.)

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PROGRESS OF INVERTEBRATE PALÆONTOLOGY IN THE UNITED STATES FOR THE YEAR 1881.

BY C. A. WHITE.

WE have not to record the death of any worker in invertebrate palæontology during the past year, and the names of those who have published the results of their investigations during 1881, are mostly well known through their previous labors. The following account of work published during the past year is not really the measure of the amount that has been done; for some of those who are most deeply engaged in the work, have published very little within that time. Those gentlemen have kindly kept me informed of the progress of the work they have in hand, and mention is made of some of these in the following paragraphs:

Mr. S. W. Ford has continued his studies of the primordial fauna, and has published a very interesting paper on the "Embryonic forms of Trilobites from the Primordial rocks of Troy, N. Y., in the *American Journal of Science*, Vol. XXII, pp. 250–259, with 13 woodcuts. Also "Remarks on the genus Obolella," in Vol. XXI, of the same journal, pp. 131–134, with 5 woodcuts.

Professor James Hall informs me that "no reports of the New York State Museum having been printed for the past three years," he has a large amount of work awaiting publication. As these works may be expected to appear soon, only brief reference need be made to them now.

[1] This paper did not appear until April, 1882, but on account of its relations to other material here treated of, the recorder has taken the liberty of calling attention to it. Those interested in deep-sea mollusks should also consult a paper in the *Journal de Conchyliologie*, by Dr Paul Fischer, entitled "Diagnoses d'espèces nouvelles de Mollusques recueillis dans le cours des expeditions scientifiques de l'aviso le Travailleur (1880–81)," l. c. pp. 49–53, Jan., 1882.

The museum report for 1880 is to contain some further work of Professor Hall's on the Bryozoans and Lamellibranchiates. The report for 1881 will contain the completion of the Lamellibranchiates and a continuation of the Bryozoans and corals, a discussion of Uphantænia and Dictyophyton, &c., &c. The report for 1882 will contain the completion of the work on Bryozoans and corals. The appendix to Vol. v, Part II, of the Palæontology of New York, with 16 plates, is near completion.

Professor Angelo Heilprin has continued his original investigations in connection with his professional duties at the Philadelphia Academy of Natural Sciences. The following is a list of the articles published by him during the past year, all of which have appeared in the Proceedings of the academy for 1881: "Notes on the Tertiary geology of the Southern United States," pp. 151–159; "A revision of the cis-Mississippi Tertiary Pectens of the United States;" "Remarks on the Molluscan genera Hippagus, Verticordia and Pecchiolia;" "Note on the approximate position of the Eocene deposits of Maryland," and "A revision of the Tertiary species of Arca of the Eastern and Southern United States." Professor Heilprin has other works in progress besides the arrangement and classification of the collection of the academy.

Professor Alpheus Hyatt has published the work mentioned in my last review, on the "Genesis of the Tertiary species of Planorbis at Steinheim," in the Anniversary Memoirs of the Boston Society of Natural History, 114 pages and 9 plates.

A synopsis of this work, together with other matter, was published in the Proceedings of the American Association for the Advancement of Science, Vol. xxix, pp. 527–550, with two plates, under the title, "Transformations of Planorbis at Steinheim, with remarks on the effects of gravity upon the forms of shells and animals." During the summer of 1881 Professor Hyatt, together with a party of his assistants and students, visited Anticosti and other places in a yacht, for scientific study. Concerning his palæontological studies, he says: "I found specimens of Beatricia showing the terminal part to be an open cup. I also found natural sections exhibiting what seem to be vertical septa similar to those of Cystiophyllum." His memoir on the Ammonites is now ready for the press.

In June of last year Mr. U. P. James published a paper in No.

5 of *The Palæontologist*, pp. 33–44, which contains descriptions of a number of species of fossils by Mr. James, under the geheral title of "Contributions to Palæontology: Fossils of the Lower Silurian formation, Ohio, Indiana and Kentucky."

During the past year Mr. S. A. Miller has published the following articles in the Journal of the Cincinnati Society of Natural History: "Description of some new and remarkable Crinoids and other fossils from the Hudson River group, and notice of *Strotocrinus bloomfieldensis*," Vol. IV, pp. 69–77, illustrated on plate 1; "New species of fossils and remarks upon others from the Niagara group of Illinois," Vol. IV, pp. 166–176, illustrated on plate 4; "Descriptions of new species of fossils," Vol. IV, pp. 259–262, illustrated on plate 6; "Description of new species of fossils from the Hudson River group, and remarks upon others," Vol. IV, pp. 316–319, illustrated on plate 8. In the second of these articles Mr. Miller describes the new genus Zenocrinus, and in the last the new molluscan genus Pyanomya. He also continues his "Remarks on the Cenozoic age or Tertiary period," in No. 4 of Vol. III, and Nos. 1, 2 and 3 of Vol. IV of the same journal.

Mr. Samuel H. Scudder is still actively engaged upon work pertaining to fossil insects. Five installments of his "Bibliography of Fossil Insects" have appeared since the first two, mentioned in my last review. These seven parts comprise something over thirty pages. His memoir on the "Devonian Insects of New Brunswick has appeared in the Anniversary Memoirs of the Boston Society of Natural History, 41 pages quarto. His article on the "Structure and Affinities of Euphoberia," appeared in the *American Journal of Science*, Vol. XXI, pp. 182–186; and that on the "Tertiary Lake Basin at Florissant, Colorado," in the Bulletin of the United States Geological Survey of the Territories, Vol. VI, pp. 279–300, and also a map. The following have also appeared from his pen during the past year: "A notice of Goss' papers on fossil insects," in *Psyche*, Vol. III, p. 138; "On two new British Carboniferous insects, with remarks on those already known," *Geological Magazine*, Vol. VIII, pp. 293–300, with one figure; "Remarks on a remarkable Carboniferous Millipede," Proceedings of the Boston Society of Natural History, Vol. XXI, p. 122; "On *Lithosialis hohenica*," *ib.* p. 167; "Relation of Devonian insects to late and existing types," *American Journal of Science*, Vol. XXI, pp. 111–117.

Mr. Scudder has also nearly completed works on fossil spiders and the Archipolypoda.

Part II of the "Revision of the Palæocrinoidea," by Messrs. Charles Wachsmuth and Frank Springer has appeared in the Proceedings of the Academy of Natural Sciences of Philadelphia for 1871, pp. 1–237, and three plates. This important and exhaustive work embraces the family Sphæroidocrinidæ, with the subfamilies Platycrinidæ, Rhodocrinidæ and Actinocrinidæ. It is greatly to be desired that nothing will occur to prevent the consummation of the plan of these gentlemen to complete this work for the whole order.

Mr. C. D. Walcott has published his memoir, which was announced in my last review, on "The Trilobite; new and old evidence relating to its organization," in the Bulletin of the Museum of Comparative Zoölogy at Cambridge, Vol. VIII, pp. 191–224, with six plates. This paper contains, among other matter, a résumé of all the evidence concerning the character of the ventral appendages of Trilobites, with illustrations of those organs. He has also published a brief article in the *American Journal of Science*, Vol. XXII, pp. 394, 395; "On the nature of Cyathophycus," in which he expresses the opinion that the genus mentioned is a member of the same group to which Dictyophyton belongs, and which Professor Whitfield has shown to have close affinities with Euplectella, or the so-called glass-sponges. He is now engaged on some palæontological work for one of the divisions of the U. S. Geological Survey.

Professor A. G. Wetherby has published the following papers in the Journal of the Cincinnati Society of Natural History: "Description of Crinoids from the Upper Carboniferous of Pulaski county, Kentucky," Vol. III, pp. 324–330, illustrated on plate 9; "Description of new fossils from the Lower Silurian and Subcarboniferous rocks of Ohio and Kentucky," Vol. IV, pp. 77–85, illustrated on plate 2; "Description of new species of fossils from the Lower Silurian and Subcarboniferous rocks of Kentucky," Vol. IV, pp. 177–179, illustrated on plate 5.

In my review for 1880 I inadvertently omitted to mention Professor R. P. Whitfield's "Notice of new forms of fossil Crustaceans from the Upper Devonian rocks of Ohio, with descriptions of new genera and species," which appeared in the *American Journal of Science*, Vol. XIX, pp. 33–42. The new genera are

Echinocaris and Palæopalæmon. During the past year he has published the six following articles: "Observations on the structure of Dictyophyton, and its affinities with certain sponges," *American Journal of Science*, Vol. XXII, pp. 132. This is accompanied with a note by Dr. J. W. Dawson. "On the structure of a specimen of Uphantænia," pp. 132, 133; "A new genus [Anthracopupa] and species of air-breathing mollusk from the Coal-measures of Ohio, and observations on Dawsonella," *American Journal of Science*, Vol. XXI, pp. 125–128, with six wood-cuts; "Description of a new species of Crinoid from the Burlington limestone, at Burlington, Iowa," Bulletin No. 1 of the American Museum of Natural History, pp. 7–9, plates 1–2; "Remarks on Dictyophyton and descriptions of new species of allied forms from the Keokuk beds at Crawfordville, Indiana," Bulletin No. 1 American Museum of Natural History, pp. 10–20, plates 3 and 4. This article contains also a reprint of Dr. Dawson's observations on Uphantænia already mentioned. Professor Whitfield is the first to announce the opinion that these and kindred bodies are closely related to the so-called glass-sponges. "Observations on the purposes of the embryonic sheaths of Endoceras and their bearing on the origin of the siphon in the Orthoce'rata," Bulletin No. 1 American Museum of Natural History, pp. 20–28, and three wood-cuts. Besides his stated work at the American Museum, he is engaged upon the palæontology of New Jersey.

Professor Henry S. Williams has published in the Annals of the New York Academy of Natural Science, Vol. II, No. 6, his complete paper on the "Life-history of *Spirifer lævis*," of which an abstract was formerly published in the *American Journal of Science*.

Professor A. S. Packard, Jr., has published, in the Bulletin of Hayden's U. S. Geological Survey,[1] a description, with figures, of a new species of fossil crayfish, under the name of *Cambarus primævus*. The specimens were from the lower Tertiary fish beds of Bear river, Wyoming Terr.

In the *American Journal of Science*, Vol. XXII, pp. 134–136, Mr. W. W. Dodge has an article announcing the discovery of Lower Silurian fossils in Penobscot county, Northern Maine.

During the past year I have published the two following works: "On certain Cretaceous fossils from Arkansas and Colorado," Proceedings of the U. S. National Museum, Vol. IV, pp. 156–139, and one plate; "Fossils of the Indiana rocks," Annual report for 1880 of the Indiana Geological Survey, pp. 103–154, and eleven plates. I have also several other works now in the printer's hand.

[1] See AMER. NAT., Vol. XV, p. 832.

THE NUMBER OF BONES AT PRESENT KNOWN IN THE PECTORAL AND PELVIC LIMBS OF BIRDS.

BY R. W. SHUFELDT.

IN many birds, as the Ætomorphæ, Psittacomorphæ, Coracomorphæ of Huxley, we find at the back and upper part of the glenoid cavity, a sesamoid long known to ornithotomists as the os humero-scapulare; this bone can in no way be claimed as belonging to the category of bones that enter the pectoral limb, as it increases the articular surface of the glenoid cavity, and in so doing properly belongs to the scapular apparatus, being accessory to the shoulder girdle.

In the arm we have then but one bone, the humerus, in the forearm, or antibrachium, we find two, the radius and ulna, and in the angle formed by the articulation of the latter two with the humerus, or the elbow, we detect in many birds (Turdidæ and others), lodged at its posterior aspect, quite a sizable sesamoid, crescentic in form, which seems to serve the purpose of protecting the joint. It reminds one not a little of a floating olecranon. Two of these sesamoids occur at the same locality among Guillemots and Penguins (Owen).

Among raptorial birds and in some few other families, we find articulating with one or both of the long bones of the antibrachium, at the distal end or ends as the case may be, another sesamoid, the os prominens.

The vast majority of adult birds, and indeed the writer does not recall a single exception at this moment, possess *two* free carpal bones, the scapho-lunar and cuneiform. To these we have to add to our enumeration, several bones that are found in the wrist of some, but not all immature birds; these eventually, we know, all become anchylosed about the proximal extremities of the metacarpals. First in this list we have os magnum, the largest, that subsequently amalgamates with index metacarpal; next in order we discover the unciform (Morse), a diminutive segment found in some birds, that finally unites with the last metacarpal, and to these four the writer, two or three years ago, added a fifth and called it the pisiform. For several reasons, however, I have been induced to change the name of this segment, and have done so in a memoir elsewhere, now in press, and called it the pentosteon, it being the fifth carpal segment discovered up to date. The name is one that cannot be productive of harm nor confusion

after its true homology has been decided upon. In manus we have quite a number of bones, but we must recollect that the list here given does not occur in all birds. Immature birds, at various ages, present us with three free metacarpals; these are pretty generally, at present, taken to be the first or pollex metacarpal, second or index, and third or middle. All three of these bones anchylose together, and with certain carpals, as mentioned above, to form in the adult the bone usually known as the metacarpal, a far better name for which would be the carpo-metacarpal.

Now pollex metacarpal may support one phalanx, or one phalanx and a claw, which may be covered with the common integument, or pierce it and be sheathed with horn. Index metacarpal may possess as many as *three* phalanges, the last or distal one exhibiting the same conditions as the distal joint of pollex; finally middle metacarpal supports a single phalanx.

To recapitulate then, we have those adult birds that possess the fewest number of bones in the pectoral limb, presenting us with a humerus, an ulna and radius, two free carpals, a metacarpal and four phalanges, *ten* in all, but the complete list of the bones of the avian pectoral limb, up to the present time, are just double this number, though we do not know a single bird that can boast of having them all, either adult or young.

The following is the complete list:

	Brachium or arm	= 1 =	humerus.
	Sesamoid of the elbow	= 2 =	
	Antibrachium or forearm	= 2 =	radius and ulna.
Carpus.	The carpal sesamoid	= 1 =	os prominens.
Carpus.	Two free carpals	= 2 =	scapho-lunar and cuneiform.
Carpus.	Other bones of the carpus	= 3 =	os magnum, unciform and pentosteon.
Manus.	Metacarpal	= 3 =	first, second and third.
Manus.	Phalanges	= 6 =	2 for pollex, 3 for index and 1 for middle.
	Total	20	

Very many more bones are found in the pelvic extremity of birds than we have just enumerated for the anterior limb, but as already remarked, probably no single bird, either adult or young, possesses them all.

The limb now under consideration is divided into thigh, leg, tarsus, metatarsus and toes.

To the thigh is allotted one bone, the femur, while on the other hand the leg or the next division below, has two principal long bones, a heavy one constituting the main support, the tibia, and

a lighter companion, the fibula, on its outer side. Up to the present date I know of but two free bones that occur about the knee-joint; the first of these is the patella, and this may co-exist with the cnemial ridge of tibia, as in Colymbus (Owen). The other is a free sesamoid found in some birds, in a notch at the head of the fibula (Speotyto). In at least one bird the head of the tibia, or rather its *proximal* extremity, may be formed by an epiphysis so large as to include in the young the extensive pro and ecto-cnemial ridges (*Cinclus mexicanus*). The fibula is never so far produced as to articulate with the tarsus or its elementary representatives. Young birds of several genera offer us for examination at the distal end of the tibia, three distinct ossifications that eventually amalgamate with that bone and with each other. These have been described by Morse and afterwards by myself in the osteology of the Tetraonidæ, as the fibulare (outer one), the tibiale (the inner one) and the intermedium (above). In many birds, *i. e.*, Centrocercus, we find a large sesamoid in the tendons at the back of the joint formed by the tibia and tarso-metatarsus. Three bones unite to form the bone of the so-called tarsus of birds; they are the second, third and fourth metatarsals, and in immature birds we find their proximal extremities covered by an epiphysis, the centrale of Morse, that may represent the united bones of the distal row of tarsus. This epiphysis may rest just on the summit of the united metatarsals and *not* include that process found at the upper and posterior aspect of the bone tarso-metatarsus, the much disputed "calcaneal" process (Centrocercus), or it may dip down behind and completely include it (Cinclus). This fact will obviously do away with my terming this process the tendinous, as I did in my osteology of Lanius, and leave quite a knotty point for ornithologists to settle in the way of serial homologies. The first metatarsal is found articulating on the lower and outer edge of the inner metatarsal as the os metatarsale accessorium. A small sesamoid may be found beyond the trochleæ of the tarso-metatarsus, as in Eremophila.

The number and arrangement of the phalanges in the feet, as found in the various families and orders of birds is too well known to enter upon in so short a sketch as this simply pretends to be. The greatest, and at the same time the most usual number of separate joints, is fourteen, distributed in the order, 2, 3, 4, 5, running from first to fourth toe respectively. Among other

birds we find only thirteen, twelve and eleven, and still fewer in such forms as the ostrich and emeu.

To tabulate our list then, we find for the

	Thigh	= 1 =	Femur.
	Leg	= 2 =	tibia and fibula.
	Knee	= 2 =	patella and sesamoid of fibula.
Tarsus	Tibio-tarsus	= 3 =	tibiale, fibulare and intermedium.
	Tarso-metatarsus	= 1 =	centrale.
	Sesamoid between them	= 1 =	tarsal sesamoid.
	Metatarsus	= 4 =	three in tarsus metatarsus and the os metatarsale accessorium.
	Sesamoid beyond	= 1 =	podal sesamoid.
	Phalanges	= 14 =	greatest number in one foot.
	Total	29	in pelvic limb.

In this enumeration the reader will observe that if I have left out any such ossifications as the tendons may assume, they properly belong to the muscular system.

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EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— The consensus of scientific opinion regarding the mental condition of Guiteau, is at present identical with that expressed in our editorial of August, 1881. The importance of the examination of the brain of this person has not been overlooked, and an investigation has accordingly been made. The brain was delivered to some medical gentlemen of Philadelphia, and the report of one of them has been published in the newspapers. The result is about what was to have been anticipated where a simply medical expert is selected for such a work. The business of the physician being to alleviate and cure disease, his studies are chiefly in the direction of pathology (or diseased structure) and therapeutics. So the investigation of the brain of Guiteau, as reported by Dr. Shakespeare, was confined to a search for the evidence of disease. Like the other medical experts who testified during the trial, he seems to be ignorant of the science of anthropology, and of the various types of structure presented by the mammalian and especially the human brain. As was the case during the trial, the question of malformation is not referred to. Yet all mental qualities, normal and abnormal, doubtless depend on peculiarities of brain structure, such as may be totally independent of the question of disease. The study of the rela-

tive sizes, etc., of the masses forming the brain, is but the threshold of the investigation. The study of the cell-structure, on which so much depends, is a work of years, and the science of the anatomy of these parts has yet to be created. And yet the report before us does not hesitate to enter the perilous question of responsibility, and to make assertions regarding the freedom of Guiteau's will! Truly the need of an education in the natural sciences for medical men was never more strikingly displayed than in the Guiteau trial, and this its irrelevent appendix.

—— It is just now the fashion among the editors of the newspaper press to decry Arctic exploration. The scientific results to be obtained by such investigations are, however, too important to be surrendered to a temporary sentiment. As long as persons are found willing to undertake such expeditions, they should be sent, and the responsibility of their fate will rest with themselves alone.

The loss of most of Lieut. DeLong's party, however, is the more to be regretted since it seems to have been unnecessary. The greater part of their number might apparently have been saved, had they divested themselves of the unreasonable prejudice against eating human flesh.

—— It has been reported that a number of the council of the British Association for the Advancement of Science, agreed to a proposition to meet in 1884, in Montreal. It is further reported that other members have expressed dissatisfaction with this course, and desire to have the decision reversed. Such a meeting in this country would undoubtedly interfere with the meeting of the American Association the same year by drawing members from it. The more agreeable alternative would be to have the meetings combined into one grand association. The only objection to this proposition is the greater mass of papers that would be brought before such a meeting, and the greater length of time required to transact its business than has hitherto been thought available for the meetings of either association.

This objection could be gotten over by restricting the number of papers; but the difficulty of doing this satisfactorily is obvious.

—— The editor of the *Gardeners' Monthly*, who is also a contributor to the New York *Independent*, has several times recently presented himself as an antagonist of the NATURALIST. Being placed by our critic in the excellent company of Mr. Darwin, Professor Gray and Mr. Riley, we have heretofore permitted our friend to enjoy the diversion all to himself. We had hoped that the failure of his attempted corrections of these well-known authorities, would have inspired him with a little caution. But we now think it time to apply the language used by the late Mr. Darwin in a letter to one of our editors, that this gentleman "is the most inaccurate man he had ever known." We think Mr.

Darwin a little severe, however, when he says, "he has done more injury to science in America, than he had ever done it good." If he had said Philadelphia instead of America, we would have been more disposed to agree with him.

—— We publish to-day an article on the Calaveras skull, by the distinguished naturalist, Dr. W. O. Ayres. Dr. Ayres gives the fossil mammalia found in the Pliocene gold gravel of California (p. 851) as the "rhinoceros, Elotherium, horse, ox, camel, etc." We pointed out in the NATURALIST for January, 1880, that the occurrence of rhinoceros and Elotherium in these beds is impossible, unless transported from a long distance. The Elotherium, especially, could only have been brought there by man from Central Oregon or farther off. For camel should be read lama.

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RECENT LITERATURE.

HOUGH'S ELEMENTS OF FORESTRY.[1]—There has long been a demand for a book on the important subject of forestry, and in some respects that want is now met in the book under consideration. The general plan of Dr. Hough's book is excellent, and difficult as the subject is, he has in the main succeeded well in presenting it in an interesting and instructive manner. The successive chapters treat of soils and their preparation; climate, etc.; reproduction from seed; propagation; buds, leaves, wood, etc.; general views in regard to forestry; forestry laws; European forestry; ornamental planting; hedges, etc.; cutting and seasoning of wood; fuel, charcoal, etc.; forest fires; other injuries; insects; preservation of wood; turpentine, rosin, and other products. The chapters covering the foregoing subjects take up somewhat more than one-half of the book, and they are for the most part quite satisfactory. The one which is most disappointing is that on insects. We may hope that in a second edition this chapter will be rewritten and supplied with figures of American insects instead of European ones.

The second half of the book consists of descriptions of particular species, beginning with the oaks. The treatment here is not as satisfactory as in the previous chapters; many important trees receive but a passing notice, if any, while others of little more or even of less value, have long paragraphs and even several pages devoted to them. For example, the red oak (*Quercus rubra*) is not mentioned, while *Q. hinesii*, *Q. densiflora* and *Q. agrifolia*, of Cali-

[1] *The Elements of Forestry*, designed to afford information concerning the planting and care of forest trees for ornament or profit, and giving suggestions upon the care of woodlands, with the view of securing the greatest benefit for the longest time, particularly adapted to the wants and conditions of the United States. By FRANKLIN B. HOUGH, Ph.D., Chief of Forestry Division, U. S. Department of Agriculture, member of the American Philosophical Society, etc. Cincinnati, Robert Clark & Co., 1880.

fornia, all of little or no value, have each a paragraph; yet *Q. chrysolepis*, the only good oak of that coast is entirely ignored. Moreover, while the white oak is discussed in but little more than half a page, more than four pages are devoted to the chestnut. Somewhat more, too, as to the relative values of the different species would have added greatly to the usefulness of the book, which, in spite of the blemishes alluded to, is a valuable one.—*C. E. B.*

SCUDDER'S NOMENCLATOR ZOOLOGICUS.[1]—The compiler of this laborious work has rendered a most important service to descriptive zoölogy, and has saved working zoölogists an immense amount of research. It comprises a list of all genera established previous to 1880, which have not been recorded or are erroneously given in the nomenclators of Agassiz and Marschall, or the indexes of the *Zoological Record;* the number of such entries being 15,939. Besides these it also includes the genera of the *Zoological Record* for 1878 and '79 (2133 names, which had not been entered in the MS. of the second part, or Universal Index, at the time of its preparation); 2d, the genera in the index of Zoologischer Jahresbericht for 1879, not otherwise given; 3d, all genera, whether previously recorded correctly or not, which were furnished by the authors themselves, and a few other names.

The aid afforded by a number of working naturalists, who have sent the compiler lists of the genera proposed by them, has been very valuable, especially the MS. additions and corrections which the late Professor Agassiz had made to his Nomenclator.

The second part, or "Universal Index," will contain, with its cross references, about 80,000 entries, including all names appearing either in the first part of the present work, or in the nomenclators of Agassiz and of Marschall, or in the indexes of the *Zoological Record* through that for the year 1877.

The Smithsonian Institution proposes hereafter to issue decennial supplements to this list, and naturalists in all parts of the world are invited to send annually to the institution lists of the genera and subgenera which they have proposed during the preceding year.

In the Nomenclator the name of each genus and subgenus is given, with the name of the proposer, the periodical or work in which it appears as well as the page, derivation, year and the order and sometimes the family to which it belongs.

REVUE DES TRAVEAUX SCIENTIFIQUES.—The Department of Public Instruction and Fine Arts, France, has commenced the issue of a monthly review, under the charge of the Committee of Historic and Scientific Works, composed of twenty-three of the

[1] *Department of the Interior:* U. S. National Museum, 22. Bulletin of the U. S. National Museum No. 19, Nomenclator Zoologicus. By SAMUEL H. SCUDDER. Part I, Supplemental List. Washington, 1882. 8vo, pp. 376.

most celebrated professors of the various sciences, with M. H. Milne-Edwards for president, Messrs. Faye and Wurtz for vice-presidents.

This review will contain not only the reports of the monthly proceedings of the committee, but also summary analyses, or at least notices relative to all the most important scientific works published in France or abroad.

As evidenced by the issue of 1881, this review will prove valuable to students in every department of science; the notices are often very full, amounting to a condensation of the work reviewed; no branch is neglected, and the list of names upon the committee is sufficient guarantee for the excellence of the work.

HOVEY'S CELEBRATED AMERICAN CAVES.[1]—This work contains a full and well-written popular account of several of the principal caves of the United States, including Mammoth, Wyandot, Luray, Weyer's, Howe's, etc. Much space is devoted to the Mammoth, which holds its own as by far the largest, grandest and longest of the series of water-worn passages and domes in the limestone strata that has yet been explored. Its known avenues amount to 223, and their length equals 150 miles, though much of this is not entered by visitors. The reader is conducted through fairy grottoes and gothic arcades, among labyrinths and over bottomless pits, until finally he emerges bewildered by the multiplicity and strangeness of the objects to be seen, and enriched by much information respecting the history and scientific aspects of the vast cavern.

Wyandot cave, Indiana, has twenty-three and a half miles of explored avenues, and contains domes and stalactitic formations that equal in beauty those of its larger rival. Weyer's, in the Shenandoah valley, would be considered a wonderful cave, were it not for the fairy scenes offered by the newer and neighboring Luray.

These caves are but the largest known out of thousands that stud the limestone regions of Kentucky, Virginia and Indiana, proofs of the power of water, impregnated with carbonic acid, in wearing away the solid rock to the drainage level. In this region every hill has its face grooved and furrowed, and the small streams disappear down sink-holes into the caverns below, to gather together and reappear at the foot of the bluffs, as strong springs or small rivers.

The fauna of the Mammoth cave, with its thirty-six species, is rich compared with that of Luray, which consist only of a few bats, rats, spiders, flies and a single myriopod (*Synopus whitei*). The curious *Mucor stalactitis* Hovey, occurs also in this cave.

[1] *Celebrated American Caverns*, especially Mammoth, Wyandot and Luray, together with historical, scientific and descriptive notices of caves and grottoes in other lands. By HORACE C. HOVEY. With maps and illustrations. Cincinnati, Robert Clarke & Co., 1882.

The work commences with chapters upon the structure and varieties of caverns, the mineral, animal and vegetable contents of caves and cave dwellings, sepulchres and temples. In these chapters a large number of valuable facts respecting the caverns of various parts of the world, whether in limestone or other rocks, are brought together.

The descriptions are accompanied by the most authentic maps and by numerous illustrations, many of them sketched under the author's direction, by J. Barton Smith, of New Haven, Conn. The writer deserves great credit, not only for information so pleasantly imparted, but for his endeavor to give, wherever practicable, precise dimensions. Under rigorous measurement, Howe's cavern, N. Y., shrinks from seven, twelve, or even eighteen miles to three, yet the wonders of its Crystal lake and Winding way undergo no real shrinkage, and underground beauties generally do not need the inflations of fancy more than those of the upper region.

A few errors in dealing with old world places are the worst blemish of the book; the author makes cavern-temples of Karnac and Luxor, while he omits all mention of Ispambul, and speaks of the Grotto Azzuro of Capri *as under "the brilliant skies of Greece!"*

He also fails to notice Cope's reports of cave expeditions in Southwestern Virginia in 1869, and of the Port Kennedy, the Durham and the Northumberland county, Pennsylvania, caves, explored by Wheatley, Cope and Leidy.

RECENT BOOKS AND PAMPHLETS.—Celebrated American Caverns, especially Mammoth, Wyandot and Luray, together with historical, scientific and descriptive notices of caves and grottoes in other lands. By Horace C. Hovey. Cincinnati, Robert Clarke & Co., 1882. From the publishers.

Injurious Insects of the farm and garden. By Mary Treat. New York, Orange Judd Company, 1882. From the author.

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Somewhat about a few medicinal plants of New Brunswick. By Dr. G. M. Duncan, of Bathurst. Before the Natural History Society of N. B., April, 1881.

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Kovte Bidrag til Nordisk Ichthyographi N. Trachypterus arcticus og Gymnetrus banksii. Af. Dr. Chr. Lütken. From the author.

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GENERAL NOTES.

BOTANY.[1]

A Botanical Excursion to Mt. Mansfield and Smuggler's Notch.—Northern Vermont is well known as one of the most interesting botanical localities in New England, from the abundance

[1]Edited by Prof. C. E. Bessey, Ames, Iowa.

of scarce and local plants found there. It was the desire to collect and study in their native haunts some of the rarest of these northern plants, that induced our party of four to visit Mt. Mansfield in July. Mt. Mansfield is the highest of the Green mountains, rising some forty-three hundred feet above sea level.

The crest of the mountain, as seen from below, bears some resemblance to the profile of a human face, and hence the south elevation of the crest has received the name of the Nose, while the northern, distant about two miles and some three hundred feet higher than the Nose, is called the Chin. The view is too well known and has been too often described to call for notice here.

We approached the mountain from the Underhill side. After a hot climb up the path we reached the top and were taken care of at the Summit House. The plants along the path up the mountain did not differ noticeably from those usually observed in the White mountains. Little was done the first day except to investigate the crest of the mountain and enjoy the magnificent view of Lake Champlain and the Adirondack mountains, but the next morning with the arrival of Mr. F. H. Hosford, of Charlotte, an enthusiastic botanist and explorer, well known to collectors by his carefully-prepared specimens, the botanical work began in earnest.

With the exception of the vicinity of the Summit House, the crest of the mountain is destitute of trees. On the Nose in a nook in the face of the cliff, we found a few specimens of the rare *Aspidium fragrans*, readily recognized by its odor of new-mown hay, which lingers long after the fronds are pressed and dried. Here also was a single shrub of *Salix balsamea*.

In the damp moss under the dwarf evergreens, near the house, we gathered *Habenaria obtusata* and the tiny *Listera cordata*, ranked by Dr. Gray in his interesting paper on the statistics of the northern flora, among the twenty-one scarcest species of the region; also *Smilacina trifolia*, frequently mistaken by the careless observer for *Smilacina bifolia* and *Goodyera repens* in bud. Along the ridge joining the Nose and Chin, numerous specimens were collected. *Ledum latifolium*, *Coptis trifolia*, *Arenaria grœnlandica* were in full flower, while *Diapensia Lapponica* forming dense mossy cushions, was ripening its fruit. *Comandra livida*, with its minute axillary flowers was at first carelessly neglected from its resemblance to *C. umbellata*.

On the sides of the mountain near the top, we noticed *Habenaria dilatata*, conspicuous with its snowy white flowers; *Kalmia glauca*, one of the prettiest of our semi-alpine plants, and *Trillium erythrocarpum*, which looked strangely out of place blooming in July. From the Chin, after carefully taking our bearings, we struck, or rather endeavored to strike, a bee-line through the brush and bogs for the Lake of the Woods, which seems, as you

look down on it from above, to be but a short distance from the summit; but of all things apparent distance is the most deceptive.

The thick undergrowth prevented us from seeing where we ought to go, and so we went astray while the damp mossy bogs and ravenous mosquitoes rendered life a burden. At length the lake was reached. On its shores grew *Streptopus amplexifolius; Claytonia caroliniana* just budded, *Andromeda polifolia* now in fruit, *Sambucus pubens, Vacinium uliginosum, V. oxycoccus, Amelanchier canadensis* var. *oligocarpa,* while *Viola blanda* abounded everywhere. We found our way back to the summit without difficulty, and returned to the house well satisfied with our day's work. The night was enlivened by the unearthly cries of the hedge-hogs which abound on the mountain; in this case they devoted their energies to gnawing an empty butter tub to secure the salt.

The next morning we left the summit covered with clouds, and descended by the carriage road to botanize in Smuggler's Notch. This pass, which received its name from the fact that it was used during the war of 1812 by smugglers in conveying contraband goods from Canada to the United States, lies between Mt. Mansfield and Mt. Shepley, hemmed in by cliffs sometimes towering to the height of 1000 feet. While Mt. Mansfield was frequently visited by botanists, the flora of the Notch remained comparatively uninvestigated. Frederick Pursh, an Englishman who traveled quite extensively in this country while collecting material for his Flora Americæ Septentrionalis, visited Mt. Mansfield in 1807, and here first saw *Aspidium aculeatum,* not before known to exist in America; but it is doubtful whether he entered the Notch. Dr. Robbins visited Mt. Mansfield in 1829, but probably not the Notch.

In 1839 Professor Tuckerman collected *Aspidium aculeatum* on the sides of Mt. Mansfield, but it is uncertain whether he visited the Notch. C. C. Frost many years ago collected this fern in the Notch, but seems not to have traveled far from the trail. Professor Eaton visited the Notch in 1855, "but got," as he says "only *Aspidium aculeatum,* a few mosses, and seventy trout."

But the rarities of the Notch were practically unknown till Mr. C. G. Pringle, a thorough investigator of our alpine flora, began the exploration of its steeps, Aug. 10, 1876, when fresh from a trip to Willoughby mountain. The next year Hoysradt and the Faxon brothers accompanied him thither, and in 1878 the Notch was visited by Professors Gray and Sargent, and others.

The flora of the Notch is quite similar to that of Willoughby mountain. A road leads to a tavern, now in ruins though formerly in some repute, at the entrance of the Notch proper. Across the road from the tavern is a large spring of clear, cold water, by the side of which we lunched. Along the side of the

road and path grew *Geum macrophyllum, Calamintha clinopodium*, scarce, *Viola canadensis, Aspidium spinulosum* var. *dilatatum, A. aculeatum* var. *braunii*, while in the moss in the crevices of the rocks, we noticed the leaves of the rare *Viola selkerkii*, marked by their deep narrow sinus. About half way through the Notch we deposited our luggage on a high boulder, as the hedge-hogs are partial to leather bags, and left the path to explore one of the precipitous ravines or dry brook beds extending up the cliff. Climbing a steep mountain ravine is sometimes no easy matter; however by dexterity and diligent use of all shrubs in the neighborhood, we made our way up as best we could. The first plant of special interest discovered, was *Castelleia pallida*. Though the flowers (properly bracts) are sometimes colored, yet in all those we noticed, they were either greenish or whitish, in striking contrast with our brilliant "painted cup" (*Castelleia coccinea*) that reddens our meadows in spring. Next *Saxifraga oppositifolia* was found hidden under a sheltering rock, but a month past flowering. Here on all sides, among the rocks and in the rifts and crannies of the cliff, were the rarities we had come so far in search of. *Saxifraga aizoides*, with its yellow spotted flowers, and *S. aizoon*, with its cream-colored flowers and singular leaves, bearing along the edge a row of white cartilaginous disks, were in full bloom everywhere. *Saxifraga aizoides* was probably unknown to Linnæus as native to America, for he says of its distribution, "*habitat in Alpibus, Lapponicis Styriacis, Westmorlandicis, Baldo.*" At the date of the publication of Torrey and Gray's Flora in 1840, neither *Saxifraga oppositifolia, S. aizoon*, nor *S. aizoides* were reported in the U. S., except at Lake Superior or in the Rocky mountains. In little clusters in the wet moss on the rocks, nodded the purple bells of *Pinguicula vulgaris*, the leaves of which were covered with a mucilaginous substance, and in some cases the margins had rolled over minute insects as so well described by Mr. Darwin in his "Insectivorous Plants." When we turned our attention from the plants at our feet and looked around, the full grandeur of our position burst upon us; far below lay the narrow valley, opposite towered high cliffs, above the rocky walls rose steeply to the summit, while the cracks and crannies high above our heads were filled with the flowers of *Saxifraga aizoon, Pinguicula vulgaris, Potentilla fruticosa* and *Campanula rotundifolia*.

Among the less noticeable plants were *Hedysarum boreale, Astralagus alpinus Draba arabisans, Artemisia canadensis, Aster graminifolius*, first described by Pursh, who founded the species on a specimen from Hudson's bay, in the herbarium of Sir Joseph Banks, *Woodsia glabella* and *Asplenium viride*, which at the date of Gray's Manual was not recorded in the U. S. After collecting what specimens we wished, we crossed, with many a slip and stumble, to a brook, along which we descended. If the ascent

was difficult, the descent was infinitely more so. We seemed about to pitch down headlong, while the wet, slippery rocks afforded such a precarious footing that the brook was preferable. The descent was a mixture of creeping, crawling, jumping and sliding, the only thoroughly enjoyable way being to sit in the bed of the brook and slide down in the water, an operation that slightly dampened the clothes. On reaching the path we took up our baggage, and shortly before sundown emerged at the upper end of the Notch; here we found a wagon waiting to carry us to our hotel at Underhill, where we arrived in due season, thus ending our excursion, feeling that we had enjoyed three days of rare pleasure.

Among the plants we did not collect, but which have been collected by Messrs. Pringle and Hosford, are *Draba incana*, *Primula Mistassinica*, *Gentiana amarella* var. *acuta* and *Polygonum viviparum*.

This brief sketch does not claim to be a study of the Notch flora, but simply records a few of its more noticeable features.

In connection with the flora of Mt. Mansfield and Smugglers' Notch, the following list of Vermont plants, given by Wm. Oakes in 1840, as not then found in any other of the New England States, may be of interest. In case of antiquated names, the modern equivalents are given in parentheses:

Anemone pennsylvanica L.
A. hudsoniana (A. multifida Poir.).
Corydalis aurea Willd.
Nasturtium natans (N. lacustre Gray).
Sisymbrium teres (Nasturtium tanacetifolium Hook & Arnn.).
Draba arabisans Michx.
Sinapis arvensis (Brassica sinapistrum Bois.). Introduced.
Cerastium nutans Rof.
Fœrkea proserpinacoides Willd.
Ceanothus ovalis Bigelow.
Lathyrus ochroleucus Hook.
Phaca robbinsii (Astralagus robbinsii Gray).
Zizia integerrima D. C.
Symphoricarpus racemosus Michx.
Viburnum pubescens Pursh.
Valeriana sylvatica Richards.
Aster ptarmicoides Torr. & Gray.
Solidago humilis (S. virga-aurea, var. humilis Gray).
Pterospora andromedea Nutt.
Justicia americа (Dianthera americana L.).
Shepherdia canadensis Nutt.
Euphorbia platyphylla L.
Quercus macrocarpa Michx.
Populus candicans (P. balsamifera, var. candicans Gray).
P. monilifera Ait.
Ulmus racemosa Thomas.
Listera convallarioides Hook.
Calypso bulbosa (C. borealis Salisb.).
Trillium grandiflora Salisb.
Zannichellia palustris L.
Carex eburnea Booth.
Equisetum variegatum Schleicher.
Aspidium aculeatum Swartz (var. Braunii Koch).
Pteris gracilis (Pellæa gracilis Hook).

—*H. W. Preston.*

BOTANICAL NOTES.—In the September *Torrey Bulletin* E. L. Greene describes seven new species of Californian Compositæ, viz: *Pentachæta alsinoides, Hemizonia lobbii, Hemizonia clevelandi, Hemizonia cephalotes, Hemizonia oppositifolia, Verbesina venosa, Microseris attenuata.*——J. B. Ellis continues his descriptions of North American Fungi in the same number, giving the characters of four new species, viz: *Valsa lutescens, V. binoculata. V. tuberculosa, V. venusta, V. ampelopsidis.*——Three new grasses are described by Dr. Vasey in the August-September *Botanical Gazette, Muhlenbergia setifolia* from Western Texas, *M. glomerata*, var. *brevifolia* from South-eastern California, and *M. sylvatica* var. *californica* from the San Bernardino mountains, Cal.——In the same journal Dr. Gray names a new plant of interesting affinities, *Parishella californica.* It is related to *Nemacladus ramossissimus*, and must consequently fall into Bentham and Hooker's tribe Cyphieæ of the order Campanulaceæ. The genus is dedicated to the Parish brothers, the well-known botanical collectors.—— The July *Quarterly Journal of Microscopical Science* contains two important botanical papers, one by F. O. Bower on the Germination and Embryogeny of *Gnetum gnemon*, and the other by Professor Huxley on Saprolegnia in its relation to the Salmon Disease. In the latter the eminent author, after careful investigation, concludes that "the growth of the fungus is the cause of the morbid affection of the epidermis, and not its consequence."——Thomas Christy's New Commercial Plants and Drugs, No. 6, a pamphlet of about one hundred pages, and published by Christy & Co., London, contains much valuable information on the vegetable fibers produced in tropical countries. Six lithographic plates of fibers prepared by Vétillart, of Paris, accompany the pamphlet, and add much to its value. Cross and longitudinal sections magnified 300 diameters are shown of the fibers of flax, hemp, jute, cotton, china-grass, New Zealand flax, Mudar bark (*Calotropis gigantea*), paper mulberry, Nepal paper-plant (*Daphne papyracea*) Esparto grass, Pita (*Agave americana*), Manilla hemp, Tecum palm, bowstring hemp (*Sanseviera zeylanica*), pine apple and "white fir." ——The most important papers in the *Journal of the Linnean Society*, No. 121, are the Action of carbonate of ammonia on Chlorophyll-bodies, by Charles Darwin, and Researches on the life-history of *Hemileia vastatrix*, the fungus of the "coffee-leaf disease," by H. Marshall Ward. The latter holds that "it may be fairly considered proved that 'leaf disease' here, as in so many other cases now known, is not antecedent to the fungus, but is consequent upon the injurious action of the mycelium." "No ground exists for considering the fungus as a 'product of vitiated plant-life,' or 'of the sap,' and just as little reason is there for the view that a sickly plant is prone to infection. Nay, experiments prove conclusively that a vigorous and healthy West Indian tree is as easily infected as one from Ceylon, and it has also been shown

that such a vigorous plant may produce more vigorous mycellium and spore-groups, *i.e.*, may disseminate more of the disease producing fungus in a given period."——A neatly printed pamphlet of seventy-five pages, entitled Houghton Farm Experiments with Indian corn, has been published by Mr. Lawson Valentine, the proprietor of the farm at Montainville, N. Y. Dr. Miles' paper on Field Experiments, which occupies more than two-thirds of the pamphlet, contains much valuable matter botanically as well as agriculturally.

ZOÖLOGY.

THE BITE OF THE GILA MONSTER (HELODERMA SUSPECTUM).—Within the last week the Smithsonian Institution has received from Acting Assistant Surgeon A. T. Burr, U.S.A., now serving in Arizona, a very fine living specimen of this lizard. I understand that Dr. Burr has had this reptile in his care for nearly six months, and it arrived here in an excellent state of health.

Heloderma suspectum Cope is the largest of our North American lizards, and is found all through New Mexico, Arizona, Lower California, and the country to the southward. I have never had the pleasure of seeing this reptile in its native haunts, but have been told by those who have been so fortunate, that it is a wonderfully striking object to behold, as well we might imagine it to be, with its shining and flinty armor of jet-black and brilliant orange, irregularly arranged over its body, darting as it does among the rocks of that arid land.

The superstitious Indians, and still more superstitious Mexicans that reside in the country where the Heloderma is found, have always regarded it with dread and fear, attributing to its bite the direst venom. Enlightened folk have entertained in their minds doubts upon this subject, indeed I have seen specimens forwarded to the Smithsonian, by collectors from the above localities, completely perforated by a large carbine ball, so careful have they been not to handle this creature alive. In view of these facts then, and this interesting part of its natural history, well authenticated cases of bites of this lizard possess sufficient value for scientific record.

Dr. Burr's specimen is not the first representative of Heloderma that we have received from our vast Southwest, for from time to time quite a number of these lizards have been sent to us alive, and they thrive quite well for a long time, feeding on eggs served to them either raw or hard boiled.

In removing them from cage to cage, or handling them for other purposes, the utmost care has usually been exercised, due to their doubtful reputation and not over gentle appearance. Mr. Henry Horan, the superintendent of the National Museum, received on several occasions slight bites from these specimens, but the wounds were never followed by any untoward symptoms.

On the 18th inst., in the company of Professor Gill of the institution, I examined for the first time Dr. Burr's specimen, then in a cage in the herpetological room. It was in capital health, and at first I handled it with great care, holding it in my left hand examining special parts with my right. At the close of this examination I was about to return the fellow to his temporary quarters, when my left hand slipped slightly, and the now highly indignant and irritated Heloderma made a dart forward and seized my right thumb in his mouth, inflicting a severe lacerated wound, sinking the teeth in his upper maxilla to the very bone. He loosed his hold immediately and I replaced him in his cage, with far greater haste, perhaps, than I removed him from it.

By suction with my mouth, I drew not a little blood from the wound, but the bleeding soon ceased entirely, to be followed in a few moments by very severe shooting pains up my arm and down the corresponding side. The severity of these pains was so unexpected that added to the nervous shock already experienced, no doubt, and a rapid swelling of the parts that now set in, caused me to become so faint as to fall, and Dr. Gill's study was reached with no little difficulty. The action of the skin was greatly increased and the perspiration flowed profusely. A small quantity of whisky was administered. This is about a fair statement of the immediate symptoms; the same night the pain allowed of no rest, although the hand was kept in ice and laudanum, but the swelling was confined to this member alone, not passing beyond the wrist. Next morning this was considerably reduced, and further reduction was assisted by the use of a lead water wash.

In a few days the wound healed kindly, and in all probability will leave no scar; all other symptoms subsided without treatment, beyond the wearing for about forty-eight hours, so much of a kid glove as covered the parts involved.

After the bite our specimen was dull and sluggish, simulating the torpidity of the venomous serpent after it has inflicted its deadly wound, but it soon resumed its usual action and appearance, crawling in rather an awkward manner about its cage.

Taking everything into consideration, we must believe the bite of *Heloderma suspectum* to be a harmless one beyond the ordinory symptoms that usually follow the bite of any irritated animal. I have seen, as perhaps all surgeons have, the most serious consequences follow the bite inflicted by an angry man, and several years ago the writer had his hand confined in a sling for many weeks from such a wound administered by the teeth of a common cat, the even tenor of whose life had been suddenly interrupted.—*R. W. Shufeldt, M.D., U.S.A., 22d September, 1882.*

[NOTE ON THE PRECEDING PAPER BY THE EDITOR.—The question as to the venomous nature of Heloderma seems to be complicated by opposing testimony. The fissured teeth have long been known to herpetologists. Dr. J. G. Fischer, of Hamburg, has

recently described[1] the efferent ducts of the salivary glands which issue at the bases of the grooves of the teeth, evidently with the effect to carry the saliva into the wound. I observed this many years ago, but do not know whether I published it, and I gave the Arizona species the name of *suspectum* on account of the impression I derived from the observation of this fact. It is, however, true that even small animals do not always die from the effect of the bite. Perhaps the condition of Heloderma in this respect is like that of the Opisthoglyph serpents which have a similar arrangement of one or more of the posterior maxillary teeth, and are harmless to man at least.—*E. D. Cope.*

A LAND SHELL NEW TO THE UNITED STATES.—*Ampelita rowelli* Newcomb can now be added to the fauna of the United States. The habitat of this species is given as Lower California in Binney and Bland, Part I, and "has been accredited to Arizona, but not on undoubted authority" (see note 256, Binney's later work).

I now have specimens collected on the Salt River mountains, about seven miles south of Phœnix, Arizona, and determined from the type for me by Dr. Newcomb.—*Henry Prime.*

GAVARRET ON ASTIGMATISM (*Revue Scientifique 15, Juillet, 1882*). —Astigmatism is an anomally of refraction of the eye caused by a difference in the refringent powers of its meridian. This may be caused by asymmetry of the curve of the cornea, (the most usual case) or of the crystalline lens, or of both. The variation may be regular or irregular. If a series of concentric black circles be placed in front of an astigmatic eye, the circles will appear, if the astigmatism be regular, as ellipses with their major axes in the meridian of the eye having the greatest radius of curve, but if the astigmatism be irregular, the margins of the circles will be irregular.

Regular astigmatism can be corrected by a suitable lens of spherical section or a combination of cylinder and sphere. The power of accommodation possessed by the crystalline lens interferes with a correct result. To obviate this atropine has been used, but this, besides other evils, may also give incorrect results, dependent upon the susceptibility of the patient.

The ophthalmometer of Helmholtz is an ingenious instrument for the measurement of this asymmetry, but the examination of a single eye needs eight readings of the instrument and long calculations.

A far simpler ophthalmometer has been invented by Drs. Saval and Schiötz. It depends upon the fact that, if the diseased eye be looked at through a lens of 10 to 20 centimetres focus, placed in a small hole pierced in the centre of a square of white pasteboard, the image of the square, reflected by the eye examined, will be rectangular in proportion to the degree of the astigmatism.

[1] Verhandlungen des vereins für Naturwissenschaft, V, 1882, fol. III.

By using other shapes of pierced cardboard and employing a spy-glass with two objectives separated by a bi-refringent prism, and provided with a graduated arc, the degree of astigmatism of the cornea can be calculated, but that of the crystalline can only be obtained by subtraction from the total astigmatism, which must be obtained by another and less precise method.

W. Leche upon the Milk Dentition and Homologies of the Teeth of the Cheiroptera.—The species the milk dentition of which was examined were *Vespertilio murinus* and *V. Daubentonii; Vesperugo Nathusii* and *V. noctula; Vesperus serotinus, V. borealis*, and *V. velatus; Plecotus auritus, Sturnira lilium*, and *Rhinolophus hipposideros*. In all the Vespertiliones the formula was: i. $\frac{2-2}{3-3}$, c. $\frac{1-1}{1-1}$, m. $\frac{2-2}{2-2}$; in Sturnira the third incisor of the lower jaw was wanting; while in Rhinolophus the only milk-teeth that could with certainty be found were: c. $\frac{1-1}{2}$, m. $\frac{2-2}{2-2}$.

In Rhinolophus the milk-teeth never break through the jaw; but remain concealed until their entire resorption.

In the other species the milk-teeth lie in more or less perfect alveoli upon the outer border of the jaws, outside and behind the developing permanent teeth. At a certain stage of development almost the entire set of milk-teeth can be found exterior to the nearly complete set of permanent ones, a singularity rendered possible by the small size and simple form of the permanent teeth. As many as 50 teeth may be found in nearly adult individuals. The milk-teeth have their crowns covered with enamel and always more or less three-lobed (the two outer lobes in some cases rudimentary), with the tips of the lobes hook-like and directed inwards and backwards. The root, always the greater portion of the entire length, is single, the second milk-incisor of Plauritas excepted.

The milk-teeth resemble each other greatly in each individual and throughout the tribe, instead of, as in other mammals, exhibiting characters similar to those of the second set. Our author considers, therefore, that both sets are typical, the first exhibiting the type of the homodont mammals, the second the higher type of the heterodont mammals. The permanent incisors are usually equal in number to the milk incisors, but in Dysopes they are $\frac{1-1}{2-2}$ against $\frac{2-2}{3-3}$; while in Desmodus the four upper milk-incisors are replaced by two enormous teeth which have not the remotest resemblance to their predecessors. From the position of the milk-molars with regard to the permanent ones, the following is the formula of the second. Vespertilio p.m. $\frac{3}{3}$ m. $\frac{3}{3}$; Plecotus p. m. $\frac{2}{3}$ m. $\frac{3}{3}$; Vesperugo p.m. $\frac{2}{2}$ m. $\frac{3}{3}$; Vesperus p.m. $\frac{1}{2}$ m. $\frac{3}{3}$; the reduction invariably taking place first in the upper jaw, instead of of in the lower, as usual in mammals. In some other genera the molars also are reduced, exhibiting in the Stenodermata a series commencing with Brachyphylla and Sturnira with m. $\frac{3}{3}$, and ending with Desmodus with $\frac{0}{1}$.

EARLY STAGES OF THE CLAM.—In the report of J. B. Ferguson, Commissioner of Fisheries of Maryland, Mr. Ryder records his observations on the early stages of the clam (*Mya arenaria*). The spawning period of this mollusk lasts from the 10th of September to about the middle of October, or for about forty days. The sex of the adults, in a spawning condition may be ascertained by opening the shell carefully and removing a small portion of the richly colored yellow body-mass with a knife, scissors or forceps. These fragments traced out in a watch-glass with a few drops of sea water, allow a milky fluid to escape. Under a magnifying power of four or five times, the eggs of the female are visible in this milky fluid as very minute white points of nearly uniform size, very nearly 1-500th of an inch in diameter. The male cells or spermatozoa are visible under a power of 250 diameters. Mr. Ryder finds it possible after a little experience to observe with the naked eye the differences between the male fluid and the eggs. In two or three hours after artificial impregnation, *i.e.* by pouring water containing the male cells over the eggs, development begins. The changes which occur in the egg succeed each other with considerable rapidity, and, as in the development of the oyster, there are very well marked periods of active change of form which alternate with periods of repose, while there is a lalateral symmetry which is just as well marked as in the oyster and unio. The development was followed as far as the formation of a gastrula, the process of which is the same as that of the oyster, and in a general way the process of segmentation of the egg of the clam appears to resemble, in its earliest stages, at least, the same process in Anodonta, as described by Flemming

ANATOMY OF THE OPHIURIDÆ.—Extensive observations upon the Ophiuridæ, carried on by M. Apostolides, at the laboratories of Banyuls and Roscoff, add considerably to our knowledge of the anatomy of that interesting group. The mouth does not open directly into the intestine, but into an œsophagus, provided with a sphincter, by which it can be opened or closed at the will of the animal. The so-called heart is in no sense a center of circulation, but is a glandular organ with an excretory canal. The vascular apparatus consists simply of a system of lacunary spaces. The body-cavity being completely closed, a perivisceral nutritive fluid circulates within it.

The genital clefts give access to ample closed sacs, carrying upon their exterior surface the genital sacs, but serving principally for respiration. The animal opens the clefts by the movement of its arms or of the muscles around the mouth, and the sacs are then filled by the action of the vibratory cilia of the inner layer. This takes place slowly, and when it is accomplished, the creature ceases to move, and the sacs drive out the water by their own elasticity. This movement of the respiratory sacs is believed to serve not only the purpose of permitting a gaseous exchange

with the nourishing fluid of the pervisceral cavity, but also to draw the blood from the arms into the peristomatic portion of that cavity, and force its return.

The blastosphere stage of the embryo is not followed by an invagination, as is usually supposed to be the case in all echinoderms, but by the delamination of the ectodermal cells to form the walls of the digestive cavity.

ZOOLOGICAL NOTES.—The publication of the Bulletin of the U. S. Geological and Geographical Survey of the Territories ends with the issue of No. 3 of vol. 6th. The contents are purely zoölogical. Mr. J. A. Allen publishes a preliminary list of the works and papers relating to the mammalian orders of Cete and Sirenia; unfortunately owing to the author's poor health, the article is incomplete, the bibliography being only brought down to the year 1840. Two papers on new moths and notes on other species by A. R. Grote close the number.——Apropos of whales, Professor G. O. Sars gives, in the Forhandlingar i Videnskabs-Selskabet i Christiania, for 1880, most excellent figures of *Megaptera boops*, $\frac{1}{32}$ nat. size; and of the finwhale, *Balænoptera musculus* $\frac{1}{38}$ nat. size; the sketches will be of standard value.——Professor Sars has also issued a well illustrated third part of his Carcinological Contribution to the Norwegian fauna, comprising his voluminous monograph of the Mysidæ.——The anatomy of the oyster, with two excellent figures, is described by Mr. Ryder in the last report of the Fish Commissioners of Maryland. How an oyster fattens, and the nature of its food and its mode and rate of growth, with figures, are given at length in Mr. Ryder's interesting report.——Professor Verrill gives, in the Transactions of the Connecticut Academy of Sciences, a historical sketch of New England Annelida, with annotated lists of the species hitherto recorded. Nine excellent plates accompany Part I.——Bulletin No. 11 of the U. S. National Museum is a very complete bibliography of the fishes of the Pacific coast of the United States to the end of 1879, by Dr. Theo. Gill.——M. Fischer recently gave before the Paris Academy of Sciences a *resumé* of his studies of the malacological fauna of the Mediterranean. The number of species obtained from all the deep dredgings (555 to 2660 metres) was about a hundred and twenty, every one of them common to the Mediterranean and the ocean.——M. Leopold Maggi, a disciple of Haeckel, in that he retains the sub-kingdom Protista for the reception of the lowest forms of life, shows that osmic acid will at once reveal the presence of protozoa in drinking water by causing their deposition at the bottom of the vessel. The micrographic analysis of the waters by this simple method may prove highly useful, since diarrhœa, dysentery, goitre, snd other diseases are thought to depend on this protozoan life.——Herr Jickeli has discovered in Eudendrium and some other hydroids histological elements which seem to prove the existence of a nervous system.

——J. M. Velasco gives, in *La Naturaleza*, complete proofs of the transformation into Amblystoma of the axolotls of the lakes Xochimilco, Chalco and Zumpango, the last situated sixteen leagues north of Mexico. The transformed axolotls are well known in the localities round the lakes, and are called by various names which signify the absence of branchiæ, also by an Aztec word signifying terrestrial axolotl. The lake of Santa Isabel becomes dry every year. As the water lowers the axolotls commence to change, and continue a terrestrial life; but the axolotls of the other lakes which contain excellent water and an abundant vegetation, change also, and the transformed axolotls are common under stones or in humid places in the mountains south of Mexico.——Professor Hy. Ward, in the *Natural Science Bulletin*, gives some interesting particulars relating to the Apteryx. There are sixteen cervical vertebræ, short and strong, and resembling those of the moa; and eight dorsal vertebræ, the last anchylosed to the sacrals, and bearing a small rib. The ribs, four of which are joined to the sternum, are broader and flatter than those of any other bird, differing greatly from the rounded ribs of the Dinornis. The pelvis resembles that of the emeu in its length, narrowness and flatness, while the legs are much like those of the dinornis, but have a comparatively longer femur.

ENTOMOLOGY.[1]

THE BUCKEYE LEAF STEM BORER.—In our account of the proceedings of the entomological sub-section of the A. A. A. S., at the 1881 meeting (see AMERICAN NATURALIST, 1881, p. 1009), we gave a short abstract of Mr. E. W. Claypole's paper on the above insect, accepting the determination of the species as *Sericoris instrutana* and mentioning the fact that the work of *Proteoteras æsculana* Riley, upon maple and buckeye, was very similar. A letter recently received from Mr. Claypole, prior to sending his article to press, and some specimens which he had kindly submitted to us, permit of some corrections and definite statements. We have a single specimen in our collection, bred from a larva found feeding, in 1873, on the blossoms of buckeye, and identical with Mr. Claypole's specimens, which are in too poor condition for description or positive determination. With this material and with Mr. Claypole's observations and our own notes, the following facts are established:

1st.—We have *Proteoteras æsculana* boring in the terminal green twigs of both maple and buckeye, in Missouri, and often producing a swelling or pseudo-gall. Exceptionally it works in the leaf-stalk. It also feeds on the samara of maple, as we reared the moth in June, 1881, from larvæ infesting these winged seeds that had been collected by Mr. A. J. Wethersby, of Cincinnati, O.

[1] This department is edited by Professor C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

2d.—We have an allied species, boring in the leaf-stalk of buckeye, in Ohio, as observed by Mr. Claypole. It bears some resemblance to *Proteoteras æsculana*, but differs from it in the following particulars, so far as can be ascertained from the poor material examined: The primaries are shorter and more acuminate at apex. Their general color is paler, with the dark markings less distinctly separated. No distinct tufts of scales or knobs appear, and the ocellated region is traversed by four or five dark, longitudinal lines. It would be difficult to distinguish it from a rubbed and faded specimen of *æsculana*, were it not for the form of the wing, on which, however, one dare not count too confidently. It probably belongs to the same genus, and we would propose for it the name of *claypoleana*. The larva is distinguished from that of *æsculana* by having the minute granulations of the skin smooth, whereas in the latter each granule has a minute sharp point.

3d.—*Sericoris instrutana* is a totally different insect. Hence our previous remarks as to the diversity of food-habit in this species have no force.—*C. V. R.*

Defoliation of Oak trees by Dryocampa senatoria in Perry county, Pa.—During the present autumn the woods and roadsides in this neighborhood (New Bloomfield) present a singular appearance in consequence of the ravages of the black and yellow larva of the above species. It is more abundant, so I am informed, than it has ever been before. In some places hardly any trees of the two species to which its attack is here limited, have escaped. These are the black or yellow oak (*Q. tinctoria*) with its variety (*coccinea*), the scarlet oak and the scrub oak (*Q. ilicifolia*). These trees appear brown on the hill-sides from a distance, in consequence of being altogether stripped of their leaves. The sound of the falling frass from the thousands of caterpillars resembles a shower of rain. They crawl in thousands over the ground, ten or twelve being sometimes seen on a square yard. The springs and pools are crowded with drowned specimens. They are equally abundant in all parts of the county, which I have visited during the past week or two—the central and southeastern.—*E. W. Claypole, N. Bloomfield, Pa.*

Efficacy of Chalcid egg-parasites. — Egg-parasites are among the most efficient destroyers of insects injurious to vegetation, since they kill their victim before it has begun to do any damage; but few persons are aware of the vast numbers in which these tiny parasites occasionally appear. Owing to the abundance of one of them (*Trichogramma pretiosa* Riley) we have known the last brood of the cotton-worm to be annihilated, and Mr. H. G. Hubbard reported the same experience at Centerville, Fla. Miss Mary E. Murtfeldt has recently communicated to us a similar experience with a species of the Proctotrupid genus

Telenomus, infesting the eggs of the notorious squash-bug (*Coreus tristis*). She writes: "The eggs of the Coreus have been very abundant on our squash and melon vines, but fully ninety per cent. of them, thus far [August 2] have been parasitized—the only thing that has saved the plants from utter destruction."

On the Biology of Gonatopus pilosus Thoms.—Professor Josef Mik in the September number of the Wiener Entomologische Zeitung (pp. 215–221, Pl. III) gives a most interesting account of the life-history of the curious Proctotrupid, *Gonatopus pilosus* Thoms., which has not before been thoroughly understood. Perris in his *Nouvelles excursions dans les grandes Landes* tells how from cocoons of parasitic larvæ on *Athysanus maritima* (a Cicadellid) he bred *Gonatopus pedestris*, but this he considered a secondary parasite, from the fact that it issued from an inner cocoon. It appears from the observations of Mik, however, that it was in all probability a primary parasite, as with the species studied by the latter (*G. pilosus*) the larva spins both an outer and an inner cocoon. The larva of *Gonatopus pilosus* is an external parasite upon the Cicadellid *Deltocephalus xanthoneurus* Fieb. The eggs are laid in June or July, and the larvæ, attaching themselves at the junction of two abdominal segments, feed upon the juices of their host. But one parasite is found upon a single Cicadellid and it occasionally shifts its position from one part of the abdomen to another. Leaving its host in September, it spins a delicate double cocoon in which it remains all winter in the larva state, transforming to pupa in May, and issuing as an imago in June.

It will be remembered that the female in the genus Gonatopus is furnished with a very remarkable modification of the claws of the front tarsi, which are very strongly developed, and differ somewhat in shape in the different species. It has usually been supposed that these claws were for the purpose of grasping prey, but Professor Mik offers the more satisfactory explanation that they are for the purpose of grasping the Cicadellids, and holding them during the act of oviposition.

It is interesting to note that there is in the collection of the Department of Agriculture, a specimen of *Amphiscepa bivittata* Say, which bears, in the position described above, a parasitic larva similar to that described by Mik. It left its victim and spun a white cocoon, but we failed to rear the imago. It is probably the larva of a Gonatopus and possibly that of the only described American species of the genus, *Gonatopus contortulus* Patton (*Can. Ent.*, XI, p. 64).

Species of Otiorhynchidæ injurious to Cultivated Plants.—Of our numerous species of this family, we know the development and earlier stages of only one species, viz., Fuller's Rose-beetle (*Aramigus fulleri*[1]). A few other species have attracted

[1] Vide Annual Report Department of Agriculture, 1878, p. 257.

attention by the injury caused by them as perfect insects. They are as follows: *Epicærus imbricatus*, a very general feeder; *Pachnæus opalus* and *Artipus floridanus*, both injurious to the orange tree. Of a few other species we know the food-plants: thus *Neoptochus adspersus* feeds on oak; *Pachnæus distans* on oak and pine; *Brachystylus acutus* is only found on persimmon; *Aphrastus tæniatus* lives on paw-paw (but not exclusively); *Eudiagogus pulcher* and *rosenschœldi* defoliate the coffee-weeds (*Cassia occidentalis* and other species of the same genus). Two very common species, *Pandeleteius hilaris* and *Tanymecus confertus* appear to be polyphagous, without preference for any particular plant. Very recently the habits of another species, *Anametis grisea* Horn, were brought to our knowledge by Mr. Geo. P. Peffer, of Pewaukee, Wis., who sent us specimens of the beetle accompanied by the following communication: "The larger Curculio I send you is working around the roots of apple and pear trees, near the surface of the ground or around the union where grafts are set. I found fifteen of the larvæ on a small tree one and a-half inches in diameter. The beetle seems to lay its eggs just where the bark commences to be soft, near or partly under the ground. The larva eats the bark only, but they are so numerous as to girdle the tree entirely in a short time."—*C. V. Riley.*

Bombyliid Larvæ destroying Locust Eggs in Asia Minor.—The eggs of locusts in Cyprus and the Dardanelles, as we learn from the Proceedings of the London Entomological Society, are much infested with the parasitic larvæ of *Bombyliidæ*, though these were previously not known to occur on the island. This fact shows that the habit which we discovered among some of our N. A. *Bombyliids* recurs in other parts of the world, and we have little doubt that careful search among locust eggs will also reveal the larval habits of some of the *Meloïdæ* in Europe and elsewhere. Indeed, notwithstanding the closest experiments of Jules Lichtenstein which show that the larva of the Spanish blister-beetle of commerce will feed on honey, we imagine that its more natural food will be found in future to be locust eggs. The particular *Bombyliid*, observed by Mr. Frank Calvert, destroying locusts in the Dardanelles is *Callostoma fascipennis* Macq., and its larva and pupa very closely resemble those of *Triodites mus* which we have studied and figured (see Vol. xv, pl. vi). We quote some of Mr. Calvert's observations:

"On the 24th of April I examined the larvæ in the ground: the only change was a semitransparent appearance which allowed of a movable black spot to be seen in the body. On the 8th June about fifty per cent. of the larvæ had cast a skin and assumed the pupal state in their little cells: the color yellowish-brown darkening to gray in the more advanced insect. About one per cent. of the cells, in which were two skins and an aperture to the sur-

face, showed the perfect insect to have already come out of them. A gray pupa I was holding in my hand suddenly burst its envelope, and in half a minute on its legs stood a fly, thus identifying the perfect insect. * * I found the fly, now identified, sucking the nectar of flowers, especially of the pink scabious and thistle, plants common in the Troad. (Later on I counted as many as sixteen flies on a thistle-head.) The number of flies rapidly increased daily until the 13th when the ground appeared pitted all over with small holes from whence the parasite had issued. A few pupæ were then still to be found—a larva the rare exception. The pupal state thus seems to be of short duration. It was very interesting to watch the flies appearing above ground; first the head was pushed out; then with repeated efforts the body followed; the whole operation was over in two or three minutes; the wings were expanded, but the colors did not brighten until sometime after. Occasionally a pupa could not cast off its envelope, and came wriggling out of the ground, when it was immediately captured by ants. Unfortunate flies that could not detach the covering membrane, adhering to the abdomen, also fell a prey, as indeed many of the flies that could not get on their legs in time. The fly for the first time (13th June) were seen to pair, but this rarely."

ANTHROPOLOGY.[1]

ANTHROPOLOGY AT THE AMERICAN ASSOCIATION.—It will be recollected by those who attended the Buffalo meeting of the Association, that by special favor the anthropologists were allowed to hold a subsection by themselves. We were there made a permanent subsection, and at Cincinnati a permanent section. It is with some pride that we refer to these things, because we have not moved always in flowery fields. Opposition from without, no doubt has been experienced, but our chief difficulty is from within. Of these, let us kindly and frankly speak. We are in the freshman class of our science, but we are in danger always of putting on the airs of seniors. The remedy is plain; it is not to leave the college and remain an ignoramus, but to be humble and not put on the airs of a senior until such time as the faculty bestow that honor upon us. In plain words, gatherers of relics, skeletons, crania, ethnological material of every kind, and the data of other branches of anthropology are most necessary in their sphere, every student of this department of knowledge must begin with this and never wholly abandon it, yet they are not necessarily scientists, their work can hardly be called science. Therefore, we shall be of all people the most unwise, if we allow ourselves to rest content with the rudiments of knowledge, and subject ourselves to the ridicule of truly scientific people. The papers read at the association were generally of a very high order,

[1] Edited by Professor OTIS T. MASON, 1305 Q street, N. W., Washington, D. C.

as most of our readers would judge by seeing the names of the authors. The full list is given below:

1. A scheme of Anthropology. Otis T. Mason.
2. The cross and the crucifix. Charles Whittlesey.
3. Notice of a collection of Sioux weapons and articles of dress. G. H. Perkins.
4. Recent archæological discoveries in Vermont. G. H. Perkins.
5. Stone implements from Bomoseen and Castleton valleys. J. McNab Currier.
6. A stone grave in Illinois. Charles Rau.
7. Chief deities in American religions. Albert S. Gatschet.
8. Beliefs and superstitions of the Iroquois Indians. Mrs. Erminnie A. Smith.
9. Home life among some of the Indian tribes. Miss Alice C. Fletcher.
10. A find of ceremonial weapons in Florida. A. E. Douglas.
11. Religious ceremonials of some of the Dakotan family of Indians. Miss Alice C. Fletcher.
12. On some hitherto unnoted affinities between ancient customs in America and on the other continents. I. W. Phené.
13. Indian migrations as evidenced by language. Horatio Hale.
14. The contents of eighty-four stone graves at Brentwood, Tenn. F. W. Putnam.
15. Discovery of the remains of a log building belonging to the stone-grave period in Tennessee. F. W. Putnam.
16. Account of mounds explored in Ohio and Tennessee. F. W. Putnam.
17. On the comparative phonology of four Sioux languages. J. Owen Dorsey.
18. The kinship system and marriage laws of the Dhegiha (Omahas, Poncas, &c.). J. Owen Dorsey.
19. Atlas and the Atlantes: 1. The Atlantes. 2. The Guanches. R. G. Haliburton.
20. Who made the native copper implements? P. R. Hoy.
21. Who built the mounds? P. R. Hoy.
22. On copper implements and ornaments from North America. F. W. Putnam.
23. A "find" of chipped stone implements on the Pacific coast, and exhibition of the specimens. H. N. Rust.
24. Remarks upon the Davenport tablet. H. N. Rust.
25. Monumental and art remains in the lake regions of Ohio, Pennsylvania and New York. Wills DeHass.
26. Influence of climate of Canada on Europeans. Wm. H. Hingston.
27. A few deductions from dictionary of the Tuscarora language. Mrs. E. A. Smith.
28. Mountain antiquities. Wills DeHass.
29. The bleaching of the Aryans. Mrs. Virginia K. Bowers.
30. Geological testimony to the antiquity of man in America. Wills DeHass.
31. Archæological exploration; progress of discovery. Wills DeHass.

A brief statement of the contents of the papers may be of use in directing those who desire to be better informed from the authors themselves.

Mr. Mason, in order to impress upon the members of the section the necessity of ascertaining accurately where each paper as well as its author stood with reference to the science as a whole, presented a scheme divided into four columns, based on the Greek words *genea*, *graphe*, *logos* and *nomos*. For the whole science, we would have anthropogeny, anthropography, anthropology and anthroponomy. And for any department of the subject a similar scheme of four would arise.

Mr. Whittlesey strenuously maintained that we have not sufficient evidence to predicate that the occurrence of the cross so frequently in American antiquities has anything to do with religion, much less with European influences of any kind.

Messrs. Perkins and Currier each described collections of great value which they had in their possession.

Dr. Rau described the opening of a stone grave in Illinois, containing the remains of a Kaskaskia Indian, thereby casting a doubt upon the opinion that the stone graves contain the remains of a race long since extinct and wholly different from our modern Indians.

Mr. Gatschet, from a long study of the religions of our aborigines, was able to classify their myths, and gave to the section the Klamath story of Old Bear and Little Weasel. The author is sure that he has discovered a substratum of nature worship under all our American religions.

Mrs. Smith has continued her researches among the Tuscaroras and other Iroquois tribes, and among other things carefully noted the manner in which the pagans took on christianity, in many cases blending the pagan rites with those of the church.

Miss Fletcher has lived in the wigwams of the Omahas, Ogalallas and Brulés, and has familiarized herself with that part of their domestic life not exhibited to the eyes of men. Her description of the sun-dance was exceptionally interesting.

Mr. Douglass exhibited a collection of beautifully polished stone implements from Florida.

Mr. Phené was one of the foreign guests, and gave an illustrated lecture upon similarities of monumental remains throughout the world.

Mr. Hale, the ethnographer of the Wilkes' expedition, from a long study of the transformations of words from tribe to tribe in our various Indian stocks, was able to make some valuable deductions respecting the former movements of our aborigines.

Mr. Putnam, in his four papers, described his own personal researches in the capacity of curator of the Peabody Museum. His large experience and good sense caused his communications to be listened to with a great deal of interest.

Mr. Dorsey, in our view, made the most valuable additions to our knowledge. Each of his papers is a monument to his great pains and personal research. In the former he has discovered a sort of Grimm's law running throughout the entire Sioux stock. In the latter he has traced with greater elaboration than Mr. Morgan, the rules of consanguinity and affinity in two of them.

Mr. Haliburton entertained the section with the recital of his experiences in the country of the Shuluhs or Shelhahs, south of the Morocco and in the Canary islands. The persistence with which old Greek and Semitic myths have continued in this region is truly marvelous.

Dr. Hoy gave the section the benefit of his experience in copper implements. On this subject there is no doubt that he is right. On the second paper the author has bestowed a great deal of labor, whether he is right or not.

Mr. Rust has lived many years among the Indians, and was able to explain some things by his experiences. The implements exhibited were very similar to those from Honduras figured in "Flint Chips."

Mr. Hingston is a surgeon of Montreal, and has been a keen observer of fecundity, longevity and vitality among Canadians, mixed up of English, Scotch, Irish and French, with a considerable sprinkling of Indians, but no German or other Europeans than those above mentioned.

Dr. DeHass, in his papers, gave the benefit of his own personal experience in exploration, and in one of them brought together all the various instances in which the antiquity of man has been alleged on our continent. We have seen these stories frequently before in different places, but Dr. DeHass has certainly done a great service in making them stand up in a line together.

The next meeting will be in Minneapolis, where more strenuous efforts must be put forth to make our section the best of all.

GEOLOGY AND PALÆONTOLOGY.

THEORIES OF THE ORIGIN OF THE LOESS.—Baron Richthofen (Geol. Mag. July, 1882) writes upon the origin of the Loess, in answer to H. H. Howorth. He states that, petrographically, stratigraphically and zoologically the Loess differs from all other formations; that in its nearly perfect homogeneousness it contrasts strongly with sedimentary strata deposited in shallow water; that between ridges of considerable height it fills up the hollows, presenting a concave surface; that its composition is everywhere hydrated silicate of lime, with some quartz and mica; that there is no stratification; that the tubes, incrusted by carbonate of lime, may be seen taken up by rootlets where vegetation occurs; that the shells are almost all land shells; that the mammalian remains are those of animals living on the steppes; and that whenever the Loess fills a basin between two hills, the slopes are covered by angular fragments of the adjoining rock. Water action will not explain these facts. Wind action will. Repeated depositions and repeated growths of grass explain the capillary structure. Dust storms in the present age deposit a measurable thickness of yellow dust wherever there is vegetation, and in districts where grass is the chief growth, successive deposits may reach hundreds and thousands of feet.

The steppe basins of Mongolia have a structure similar to that of the Loess, and all that is needed to give those basins the characteristic Loess scenery is water and an outward drainage.

Baron Richthofen's paper is followed by a continuation of Mr.

Howorth's, giving the evidence of the valley terraces in favor of a great post-glacial flood; and in the succeeding number Mr. Howorth publishes a rejoinder to Baron Richthofen. He urges that he, as well as Baron Richthofen, believes in the original sub-aerial nature of the deposits, as proved by the animal and vegetable remains, but that what is called the Loess is this old land surface redistributed by the catastrophe which closed the Mammoth period and formed the gap between Palæolithic and Neolithic man. He denies that the genera and most of the species of mammals found in the Loess are such as now abound in steppes, for the mammoth and the rhinoceros, the characteristic quadrupeds, are forest animals; and he asserts that the probabilities are that the lime-lined capillary tubes, which do not occur at a greater depth than 45 feet, were formed by the percolation of water. Wind-driven deposits would be sorted, the heavier dropped first, whereas heavy grains occur throughout the Loess, mixed with the lighter. Baron Richthofen asserts that the Loess-covered portions of Europe must have had a steppe climate long enough for the deposit to be formed, but if so, how could the Helices and other damp-loving molluscs exist? Whence did the dust come to form this vast deposit? Wind blowing over grass raises no dust. As, according to Baron Richthofen the steppes of Mongolia are really Loess, and as the Loess is known to exist in Russia, where can we possibly look for a dry area large enough to supply this dust?

Mr. S. V. Wood contributes an additional theory to this much vexed question. In arctic climates where the soil is not covered by ice, the surface would annually thaw and be converted into mud by the melted snow. On all inclined surfaces it would slide downward from the frozen soil below, and thus leave a fresh surface exposed to the same agencies. Repeated depositions of this mud would fill the valley, and constitute the Loess.

The Recent Discoveries of Fossil Footprints in Carson, Nevada.—Monday evening, Aug. 28th, the California Acad. of Scien. held a special meeting, with Vice-President Justin P. Moore in the chair, to hear a carefully prepared paper on the "Carson Footprints," read by Joseph Le Conte, M.D., L.L.D., Professor in the Universityof California. He began by explaining that his attention was first attracted to the Carson prison stone quarry in 1868, when he received from it the tooth of a species of the horse. On June 20th, 1882, he first reached the quarry and saw the footprints now uncovered, and found there the Committee of the Academy diligently at work, with whom he, as only a member, desired most heartily to coöperate. He then described the locality as a remnant of a sandstone elevation, which had been cut into by erosion. An opening about 100 yards square had been quarried into the ledge, which is surrounded on three sides by vertical cliffs from 10 to 32 feet high, on the floor of which the nearly

level strata appear well exposed. The strata consist of heavy bedded, grayish and creamy sandstone, separated by thin layers of shale. The sandstones in many places, especially in the eastern cliff, are strongly affected with cross laminations, indicating deposit by rapid shifting, overloaded currents—in other words, river flood deposits. We have, therefore, the mouth of an ancient stream. There appear to have been two shale floors about two feet apart, on which layer tracks are found. The whole area uncovered is literally strewn with these tracks. Parts of the area cleared have been trampled over by men and horses for eight or ten years, without attracting scientific attention. Their importance was first recognized by the intelligent Warden, Major Garrard, and their hardness has been the means of preserving them. Besides the tracks, a considerable number of fossils have been found which may assist in determining their age. Among these are fragments of tusks and molars of an elephant, and molars and fragments of jaws containing molar teeth of two species of horse. These were but imperfectly petrified. Two species of fresh-water shells have been found, an Anodonta and Sphærium, also one Gastropod, Physa. Vegetable remains are also abundant, occuring mostly as matted masses of silicified herbaceous plants. The age of the strata seems difficult to determine, but judging from the mammalian remains alone, there can be no doubt that the deposit is either Quaternary or the Upper Pliocene.[1] The molars discovered at Carson, above the tracks, indicate the *Elephas primigenius* rather than the *americanus*. The teeth of the horse indicate the *Equus major*, which although similar to modern horses, was somewhat larger. The lithification of the strata and fossilization of plants and organic remains, and the slight tilting of the strata, may be adduced as evidence of an earlier age than the Quaternary. The strata somewhat resemble a lake terrace deposit. Although Miocene lake deposits are here not far off, Professor Le Conte thought the presence of horse and elephant a bar to that age. The ancient Pliocene lake was the most extensive, covering the whole basin region from the Sierra Nevada to the Wahsatch. Its extensive deposits have been largely covered up by the later deposits of the two great Quaternary lakes in the same region. Carson plains was about 240 feet above the level of these latter lakes; hence, a smaller and very shallow contemporaneous lake must have existed at a higher level, probably emptying into the greater lake.

The tracks supposed to be human naturally excite the greatest interest, being several hundred in number. No one who studies them can fail to observe their remarkable general resemblance to human tracks, both in their form and in the apparent singleness of each impression. Their size calls for explanation; although

[1] The age was indicated as Pliocene from specimens sent one of the Editors, in the NATURALIST, March, 1882, p. 195.

well defined as rights and lefts, their straddle is unusually wide. He thought they might have been made by a human foot enclosed in a rawhide sandal much larger externally than the foot. This would at first make a flat track until soaked through, after which it would leave a round impression, but no toe marks. If not by man the tracks could only be made by some clumsy plantigrade quadruped like a bear or a gigantic ground sloth, Mylodon, such as lived in the Quaternary. Professor Le Conte desired to hold his final scientifically expressed opinion in reserve, awaiting further testimony. The interest among scientific men is intense on any subject calculated to show evidence of the antiquity of man, especially in Pliocene or Miocene ages.

ORIGIN AND MODE OF FORMATION OF SALINE MINERAL WATERS.—M. Dreulefait, in a lecture upon this subject recently delivered before the French Scientific Association, took occasion to discredit the usual theories which attribute the formation of the beds of the gypsum, rock-salt, etc., that mineralize such waters, to the action of sulphuric acid from the depths of the globe, or to any other *internal* agency, and to attribute their origin entirely to causes acting *exteriorly* to the primitive crust of the earth.

The rocks forming the first solid envelope must have solidified at a temperature of 2000° to 2500° C., at which chlorine, sulphur and their combinations must have existed completely disassociated in the atmosphere. Chloride of sodium would form at a comparatively high temperature because it can support such a temperature without disassociation of its elements, but chloride of magnesia could not, since it decomposes at 100 C. in the presence of water, have been formed until the temperature of the earth was about 100 C., and the greater part of the water was already condensed.

Here, then, is the source of the salts found in the earth's crust, in the sea, and in mineral waters. The water, condensed by the lowered temperature, dissolved the soluble salts already deposited, as well as those continuously produced by the action of the acids within it. These salts were principally sulphides and chlorides produced by the union of sulphur and chlorine with the metals sodium, lithium, potassium, calcium, and magnesium already deposited in the more ancient crust of the earth.

Thus the masses of chloric and sulphuric salts which exist in the sedimentary beds of the globe have been formed by the spontaneous evaporation of isolated portions of the ocean.

This can be verified by the facts which occur in the evaporation of sea-water for the production of salt. The substances precipitated, in the order of their occurence, are :

1. A feeble deposit of carbonate of lime with traces of strontian, and of sesquioxyde of iron mixed with a little manganese.

2. Gypsum. This deposit does not occur until the water has by evaporation diminished to one-fifth of its original volume.

3. Common Salt. The deposit of gypsum ceases when .88 of the original volume of water has evaporated, and that of salt commences when only one-tenth of the volume remains, and continues till that quantity has been reduced one-half.

4. Sulphate of magnesia. A still further evaporation causes the deposition of this salt, mingled however, with chloride of sodium. When the only three parts out of a hundred remain, the quantities of sulphate of magnesia and common salt are equal.

5. Carnallibe, or double chloride of potassium and magnesium. This is deposited when the water has been reduced to a little less than one-fiftieth of its original volume.

Spontaneous evaporation goes no further; a bitter mother liquor is left that never dries at the ordinary temperature of the hottest regions of the globe. This liquor contains much chloride of magnesium.

Taking these facts in their order, and applying them to the saline beds found in different parts of the earth, it is evident that the substances last deposited must be rarest, since at each stage the evaporation is more advanced, and the chances favorable to further deposition diminished. This is borne out by the facts, since gypsum is most common, chloride of sodium next. We may also predicate that if one of the substances last deposited in artificial evaporation be found in the crust of the earth, beds of all those substances which are previously deposited will be found around it. This is always the case, gypsum occurs without common salt, but never common salt without gypsum. At Strassfurth, Prussia, all these substances occur, with, in addition, boracic acid combined with magnesia. Chemists have been of opinion that since "borate of magnesia is almost insoluble in water, it ought to have been deposited in the inferior beds," and have appealed to volcanic agency to explain its occurrence. Analysis, however, shows that boracic acid exists in the mother liquor left after evaporation, and in such quantity that spectral analysis, or the flame of hydrogen, reveals its presence in a single drop.

Thus boracic acid, occurring abundantly in the midst of the deliquescent salts of the mother liquor, ceased to be a rare substance, and may be expected to be found where deposits of gypsum and salt occur, and there only. M. Dreulefait goes on to state that he has proved his deductions by observations carried on throughout a considerable portion of Southern Europe and Northern Africa, and has come to the conclusion that the presence or absence of volcanic agencies makes no difference to the quantity of boracic acid found in saliferous districts. The salt springs of the non-volcanic parts of the south of France, Switzerland, and Germany are as rich in boracic acid as those of the ophitic districts of Engadine or the Pyrenees.

The lecturer then treated of the salt pools formed in the delta

of the Rhone, and showed how they are repeating the action by which the older beds of gypsum and salt were formed. The Karabogaz or Black Gulf on the east of the Caspian sea has already deposited the remains of all its forms of life, and is nearly ready to deposit gypsum. A narrow channel communicates with the Caspian, through which it can be calculated that 350,000 tons of solid matter pass in twenty-four hours, ever to remain in the gulf, since the channel is too shallow to admit of any counter-current. Complete separation, which must ultimately be caused by the proved lowering of the level of the Caspian itself, will in time cause the Karabogaz to become concentrated sufficiently to deposit its chloride of sodium.

The water of the dead sea is a mother liquor, from which the saline masses found around it have been derived. M. Lorbet, in his explorations of Palestine, discovered, especially around Lake Tiberias, now 212 metres below the Mediterranean, a plateau covered with rolled pebbles exactly at the level of that sea, and indicating that at a former epoch Lake Tiberias, the Jordan valley, and the still lower Dead sea, with the regions around them, formed a gulf like that of Karabogaz or like the pools of the estuary of the Rhone.

THE SO-CALLED LEADVILLE PORPHYRY. — Professor Alexis Julien read a paper at the Montreal meeting of the American Association, on this subject, in which he described the result of his examination of the rock in question, in thin sections under the microscope. He finds that it is not an eruptive rock, but is sedimentary. Its material consists of the debris of the erosion of plutonic rocks, redeposited in the Silurian ocean. He concludes that the rock is not a porphyry but must be called a felsite tufa. The importance of this conclusion in estimating the form of any metallic ores contained in this deposit, is obvious, and will be invaluable to mining experts.

PERMIAN VERTEBRATA.—Professor Cope read a paper before the American Philosophical Society in which he described the pelvic arch of the *Diadectidæ*, and the following new species from the Texas Permian: Pelycosauria, *Edaphosaurus* (g. n.) *pogonias*, which is allied to *Pantylus*, and proves that that genus must be placed in the Theromorphous order. *Ectocynodon aguti*. Microsauria, *Diplocaulus magnicornis*, a remarkable species with a large flat horn on each side of the cranium. Rachitomi, *Acheloma* (gen. allied to Eryops) *cumminsi*, and *Anisodexis* (g. n. allied to *Leptophractus*) *imbricarius*.

GEOLOGICAL NEWS.—In the *American Journal of Science*, S. H. Scudder shows that Palæocampa, from the carboniferous strata of Illinois, is a myriapod of a new and strange type. Palæocampa has ten equal body segments, each with a pair of stout, blunt legs, and four stiff-spreading bunches of spines of complex structure.

The Archipolypoda of the Mazon creek nodules have stout forked spines and two pairs of legs to each segment. Palæocampa may therefore be considered as a precursor of the Chilopoda, just as the Archipolypoda are the precursors of the Diplopoda, and the discovery of these types prove that at this early period the divergencies of structure among myriapods were as great as they are to-day.——In the same journal Messrs. McGee and Call write upon the Loess of Des Moines, Iowa, giving faunal tables of the fossils, which have a less aquatic facies than the modern mollusca of the same district.——Messrs. Scott and Osborn describe *Orthocynodon*, an ancestor of the Rhinoceros, from the Bridger Beds of Wyoming. It is the oldest known representative of the line, and differs from Amynodon in the erect lower canines, similarity of premolars and molars and other particulars. He has little of the rhinocerotic character in the skull, but the possession of canines and loss of the median incisors point it out as related to Amynodon.

MINERALOGY.[1]

THE ACTION OF HEAT UPON CRYSTALS OF BORACITE.—Mallard contributes to the Mineralogical Society of France an interesting paper upon the change which heat produces in the optical properties of boracite. The leading mineralogists of Germany—Klein, Zirkel, Groth, etc., hold that such changes are due simply to unequal internal tension, such as may be produced in glass. That the biaxial character caused by heat is an essential and characteristic character of boracite, due to the twinning of twelve rhombic crystals around a point, is again strongly urged by Mallard in the present paper. He supposes each individual of the *pseudo-symmetrical* crystal to be a pyramid whose base forms a face of the external dodecahedron, and whose summit is at the center of the crystal. By cutting sections in various directions through the crystal, and examining them optically both before and after heating, he shows that there are persistent optical properties which cannot be explained by irregular tension. He concludes that by the action of an intense and prolonged heat, a series of very thin plates are formed, alternately twinned with each other according to a definite crystallographic law. He shows that analogous phenomena may be produced by the action of heat upon sulphate of potash, and that such invariable phenomena could not be produced by tension or pressure in a colloid substance.

PREHNITE.—This zeolite, so frequent in rocks of igneous origin, and recently found to so frequently exhibit curious optical properties, has been carefully described by Professor B. K. Emerson in its associations and alterations in the Deerfield Dike of Connecticut. Prehnite is regarded as the oldest mineral in the veins in which it appears. Frequently the motion of the rock walls produces slickensides upon the prehnite, and sometimes

[1] Edited by Professor H. CARVILL LEWIS, Academy or Natural Sciences, Philadelphia, to whom communications, papers for review, etc., should be sent.

breaks it up into sheets, which are re-cemented by prehnite. The prehnite often encloses diabantite, and then varies in color from deep oil-green to jet-black. This black prehnite is sometimes combed out by the slipping rock into long fibres, resembling hornblende or chrysotile. The prehnite also occurs as a finely crystallized double cone or spindle, forming beautiful specimens. This peculiar form is the result of the twinning of three individuals around a common axis, and the resulting optical properties are peculiar. Prehnite also occurs in amydaloidal cavities which are blackened as though held in the flame of a candle. A black substance covers the fibres of prehnite, looking like a net-work of soot-covered cobwebs. This black substance is the result of alteration, and is probably chlorophæite. In other cases the prehnite has changed into a pale-green scaly mass, which appears to be diabantite.

American Monazites.—In the *American Journal of Science* for October, Professor E. S. Dana and Mr. S. L. Penfield contribute valuable articles upon American monazites. From a careful measurement of a small monazite crystal from Alexander county, North Carolina, by Professor E S. Dana, the following axial ratio was obtained:

$$c \text{ (vert)} : b : \grave{a} = 0.95484 : 1.03163 : 1$$
$$\beta = 76° 20'$$

A table is given containing a list of the more important angles calculated from these data, and agreeing closely with the results of goniometrical measurement. The axial ratio is closely related to that of monazites from other localities.

Mr. Penfield has analyzed the monazites from Portland, Ct., from Burke county, N. C., and from Amelia county, Va. The latter is the substance originally thought to be an altered microlite. Each analysis showed a considerable percentage of thoria, there being over fourteen per cent. in the monazite from Amelia county, Va. In each case, if the thoria is omitted from the analysis, the ratio is obtained of $(Ce, La, Di)_2 O_3 : P_2 O_5 = 1 : 1$, this being the ratio of a normal phosphate of the cerium metals, $R_2 P_2 O_8$. Moreover, there is just sufficient silica in each analysis to make a thorium silicate. Since, therefore, some monazites contain no thoria, and the thoria is here present in varying amount, it is probable that thorium silicate exists as an impurity. That this is indeed the case was proved by examination of a thin section of the mineral under the microscope. A dark resinous substance was seen scattered through the section, and when the latter was moistened with hydrochloric acid, white blotches, composed of gelatinous silica took the place of the resinous spots, the rest of the section being unchanged. It is evident, therefore, that the thorium silicate is a foreign admixture in the monazite. It probably exists as thorite or orangite.

MINERALS FROM PIKE'S PEAK.—Pike's Peak has already become famous for the number and beauty of the mineral species in its vicinity. Besides the extraordinary specimens of amazon-stone (microcline) from that locality, there have been found smoky quartz, albite, fluorite, biotite, siderophyllite, columbite, gothite, arfvedsonite, astrophyllite, zircon, limonite pseudomorphs, etc. Most of these occur in cavities in granite. Recently Messrs. W. Cross and W. F. Hillebrand have added several species, new to this locality. Several crystals of colorless or pale greenish *topaz* were found, one specimen being a fragment, which must have belonged to a crystal a foot in diameter. Two imperfect crystals of *phenacite* were found, this being the first locality known in the United States. *Cryolite*, *thomsenolite* and several undetermined species were also found.

MINERALOGICAL NOTES.—The *volcanic ash* ejected from Vesuvius during the eruption of February 25, 1882, has been analyzed by Ricciardi. The ash was black and magnetic. When heated, it gave off hydrochloric acid. It contained particles of magnetite and awgite, and numerous crystals of leucite. As shown by analysis, it also contained a small percentage of apatite. Sulphate and chloride of ammonium were also present, and could be dissolved out by water.

Mountain cork has been recently used in Germany as a substitute for animal charcoal for the removal of color from molasses. The mountain cork, a variety of amphibole, is dried, ignited and soaked in molasses, then again dried and ignited. This process is repeated several times until some 3.5 per cent. of carbon has become fixed in the mineral, which is then ready for use. It is more efficient than charcoal in removing the alkalies from molasses.

GEOGRAPHY AND TRAVELS.[1]

DE BRAZZA'S EXPLORATIONS ON THE OGOWÉ AND THE CONGO.—At a recent meeting of the Geographical Society of Paris, M. Savorgnan de Brazza described his recent journeys in the territory between the Ogowé and Congo Rivers, of which, previously, few details had been known. He was directed by the French Government to trace the Alima River, discovered by him on his first expedition (1875–8), to its junction with the Congo and to establish stations on the Ogowé and the Congo.

M. de Brazza left France in December, 1879, ascended the Ogowé, and succeeded in negotiating with the tribes on its banks and establishing a regular system of transport on the river. He founded his first station, Franceville, at the confluence of the Passa with the Ogowé. From here in June, 1880, he dispatched 770 natives in 44 canoes to meet his coadjutor, Dr. Ballay, at the coast, and then started alone, with a small party of natives, for the Congo.

[1] Edited by ELLIS H. YARNALL, Philadelphia.

Two or three days journey from Franceville, the nature of the country changes. To the clayey soil of the Ogowé basin and its richly wooded and moist valleys succeeds a sandy, arid, and hilly country, with here and there, in the neighbourhood of a village, a group of palm trees. This is the aspect of the country which forms the water shed between the Ogowé and the tributaries of the Upper Congo; and it is a singular fact that these narrow sandy tracts of country, along the water's bed, are everywhere inhabited by one and the same tribe, the Batéké, reputed, probably erroneously, to be cannibals. When he had passed the Leketi, a southern branch of the Alima, his route lay across the plateau of the Achicuya, an elevated district lying about 2600 feet above the sea-level, and separated from another similar plateau (the Aboma) by the River Mpama. The chief of the Achicuya received M. de Brazza in a friendly manner, and a similar reception awaited him on reaching the Aboma tribe. These latter are a fine race of people, handsomer and braver than any he had yet met with. It was here that M de Brazza first received definite information regarding the Congo and the powerful chief Makoko, whose sovereignty the Aboma acknowledge. Leaving their district, the party next travelled along the Lefini River—the Lawson of Mr. Stanley. M. de Brazza had just finished constructing a raft for the navigation of the stream, when a messenger from King Makoko arrived with offers of friendship. This much facilitated his further proceedings. He descended the Lefini with the envoy as far as Nyampo, leaving there the raft and journeying by land for two days across an uninhabited table-land. His march over a sun-scorched plateau was most wearisome, and he was beginning to find fault with his guide, when at 11 o'clock at night, after a forced march, he came in sight of the Congo. It appeared like an immense sheet of water, the silvery sheen of which contrasted with the sombre hue of the lofty mountains around. Towards the north-east the water-line extended to the horizon, and the river swept in a noiseless, slow current past the foot of the hills beneath him.

From here he visited Makoko, who gave him a most friendly reception, and entertained him for twenty-five days. A treaty was finally concluded by which the king placed his states under the protection of France, and ceded a tract of country, to be selected by M. de Brazza, on the shores of the Congo. Another treaty was also arranged with the Ubanji, who appear to occupy the region between the Alima and Stanley Pool. The second French station was placed at Ntamo, on the left bank of Stanley Pool, which M. de Brazza considers the key to the Congo interior. Stanley Pool is 93 miles nearer to the Atlantic coast than is indicated on Stanley's map.

By these treaties and discoveries, M. de Brazza maintains that the rights of priority of the French nation are clearly established

over the region between the Ogowé, the Equator, and the Congo and over the tract of country on the southern bank of the Congo from Impila to the confluence of the River Djué, to the south of Stanley Pool.

The station at Ntamo was established on October 1, 1880, and named Brazzaville. Leaving the station in charge of a sergeant and three men, M. de Brazza tried to find a new route to the sea by the valley of the N'Duo, which empties itself into the Niari and leads from Ntamo to the coast in a nearly due westerly direction. He was obliged, however, to abandon this, and continue his journey down the Congo. He arrived at the Gaboon in December, 1880. Failing to find Dr. Ballay or any reinforcement for his expedition here, he again, for a third time, ascended the Ogowé and reached Franceville in February, 1881, where he found about 100 natives engaged in various industries and the settlement self-supporting. During the following six months preparations were made to transport a steamer, to be sent in sections, from France, from the Ogowé to the Alima—a path being cleared by 400 laborers. This steamer has, however, not yet reached the Ogowé.

In October, 1881, M. de Brazza set out from Franceville to endeavor again to explore the Niari valley route, from Stanley Pool to the Atlantic. He was more successful in this second attempt. The Niari proved to be a beautiful river which enters the Atlantic under the name of Quilliou, and flows for a long distance without rapids or falls past a broad, fertile, and densely peopled valley, lying athwart the great parallel terraces over which, ladder-like, the neighboring Congo has cut its bed on its way to the ocean. After many adventures, including a fight with a hostile tribe, M. de Brazza reached the coast at Landana on the 17th of April, 1882.

The valley of the Niari is the best line for a railway to Brazzaville or Ntamo.

Should the French choose to avail themselves of these discoveries, and occupy and hold the stations established by M. de Brazza, the political as well as geographical results can not fail to be of great importance.

The London *Athenæum*, however, asserts that the road along the Congo is far preferable to the route of M. de Brazza, which is considerably longer, and leads to a part of the coast where communication with the land is only possible in surf-boats, while the Congo is accessible at all times to vessels of the largest burthen.

Mr. Stanley has recently returned to Europe. He has now seven steamers on the Congo, and has founded four factories on ground ceded by the native kings.

STEARNS' EXPEDITION TO LABRADOR.—The Stearns' Expedition to the coast of Labrador, reached home safely, on the 12th of September. Mr. Stearns went as far north as Triangle Harbor, a few miles

above Square Island. A number of specimens of various kind were taken, but the greater part of the time was spent in hand dredging. The results have been sent to the Smithsonian Institution, and will soon be published. Mr. Stearns is about publishing a work on Labrador that will probably combine the greater part of our present information on that subject. It will be uniform with his New England Bird Life, the second volume of which will soon appear, and probably come out under the name of the same publishers, Messrs. Lee & Shepard, of Boston, Mass.

MICROSCOPY.[1]

MICROSCOPY AT THE AMERICAN ASSOCIATION.—The first meeting of the new section of Histology and Microscopy, during the Montreal meeting of the American Association, fully justified the recent action of the Association in thus enlarging the scope and prominence of its former subsection of microscopy. Large and interesting sessions were held on four days during the week of the meeting, and many important papers were read. Easily first among the attractions of the meeting was the presence of the honored leader in microscopy, Dr. Wm. B. Carpenter, of London, and many microscopists who have heretofore only admired his judgment and skill as an author, found new pleasure in his genial presence, and in his thoughtful, suggestive and conclusive remarks. His rational and conservative views in regard to angular aperture were received with evident approval by the audience.

MARTIN'S UNMOUNTED OBJECTS.—The unmounted material from the laboratory of the late Mr. John Martin, of Maidstone, England, has been forwarded by his family to the Natural Science establishment of Professor Henry A. Ward, of Rochester, N. Y. It consists of a variety of hairs, scales, feathers, spines, spicules, seeds, pollens, sections of skin, hoofs and horns, infusorial earth, diatoms, foraminifera, etc. The specimens are folded in papers, and packed in small pill boxes. They are offered for sale at ten cents per box.

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SCIENTIFIC NEWS.

— Professors Silliman, Johnson and Brewer, of the National Academy's committee on sorghum culture, have been visiting Rio Grande, near Cape May, New Jersey, for the purpose of inspecting Mr. Hilgard's sugar works there. They consider the success of the method there adopted, as assured. The sorghum crop has long been an important one in this country, and its true status will now be more generally known, through the labors of Mr. Collyer and this committee.

—Dr. W. Kowalevsky of Moscow is at present in this country, and is studying the fossil vertebrata of Prof. Cope's collection in Philadelphia.

[1] This department is edited by Dr. R. H. WARD, Troy, N. Y.

— Professor Owen has dubbed the anti-vivisectionists, bestiarians, to distinguish them from the humanitarians.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—The following is a list of the papers read in the biological section:

SECTION F—BIOLOGY.

The fertilization of Yucca. Thomas Meehan.
Demonstration of a series of Brains prepared by Giacomin's method. William Osler.
Description of a new species of Alcyonoid Polyp. Robt. E. C. Stearns.
On the Polymorphism of *Lycæna pseudargiolus*. W. H. Edwards.
Note on the sterility of the Canada thistle at Yellow Springs, Ohio. E. W. Claypole.
On the mouth of the larva of Chrysopa. Wm Saunders.
Some remarks on the flora of North America. Professor Asa Gray.
Achænodon from the Bridger Eocene beds. Henry F. Osborn.
The Placental development in Mammals. Henry O. Marcy.
The motion of roots and radicles of Indian corn and beans. W. S. Beal.
Observations on the fertilization of Yucca, and on structural and anatomical peculiarities in Pronuba and Prodoxus. C. V. Riley.
A sketch of the history of our knowledge of the Budding of Salpa. W. K. Brooks.
Fritz Müller and the Nauplius of Decapods. W. K. Brooks.
Examination of some controverted points of the physiology of voice. T. Wesley Mills.
Illusions of motions, with exhibition of apparatus. H. P. Bowditch.
Cross Heredity from sex to sex. Mrs. A. B. Blackwell.
Achenial hairs and fibers of Compositæ. G. Macloskie.
Blastesis tridens: a pear-tree fungus. Wm. H. Seamen.
On a recent species of Heteropora from the strait of Juan de Fuca. J. F. Whiteaves.
Insects *versus* flowers in the matter of Fertilization. E. W. Claypole.
On the Gall-mites. W. A. Buckhout.
A sketch of the history of our knowledge of the budding of Salpa. W. K. Brooks.
Fritz Müller and the Nauplius of Decapods. W. K. Brooks.
A new sexual character in the pupæ of some Lepidoptera. J. A. Lintner.
On the position of the Gamopetalæ.
Note on the occurrence of traces of a northern flora in Southwestern Ohio. E. W. Claypole.
Progressive growth of dermoid coat of the membrana tympani. Clarence J. Blake.
The morphology of arteries. Frank Baker.
Emulsions of petroleum and their value as insecticides. C. V. Riley.
The Jessup collection to illustrate American forestry in the Museum of Natural History, Central Park, N. Y. Albert S. Bickmore.
The hibernation of *Aletia xylina* in the U. S. a settled fact. C. V. Riley.
Observations on the elm-leaf beetle (*Galeruca xanthomelæna*). G. Macloskie.
The organic compounds in their relation to life. Lester F. Ward.
The primary divisions of the Ungulata. Edward D. Cope.
On the habits of Cryptobranchus. Burt G Wilder.
Classification of organisms. Lester F. Ward.
Some observations on the action of frost upon leaf-cells. C. E. Bessey.
The fauna of the Puerco Eocene. Edward D. Cope.
Remarks on the Turbellaria. Wyllis A. Silliman.
On an egg parasite of the currant saw-fly, *Nematus ventricosus*. J. A. Lintner.
Monograph of the Clematidæ of the United States. Joseph F. James.
Notes on the flora of the Rocky mountains. Sereno Watson.